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## SPECIAL NOTICE

The U. S. Atomic Energy Commission has reviewed its classified reports on an accelerated basis to release the maximum amount of information possible to the national nuclear energy program. Older reports declassified in this review program are being announced in supplements to regularly scheduled issues of *Nuclear Science Abstracts*. Current unclassified AEC reports are announced routinely in the semimonthly issues of *Nuclear Science Abstracts*.

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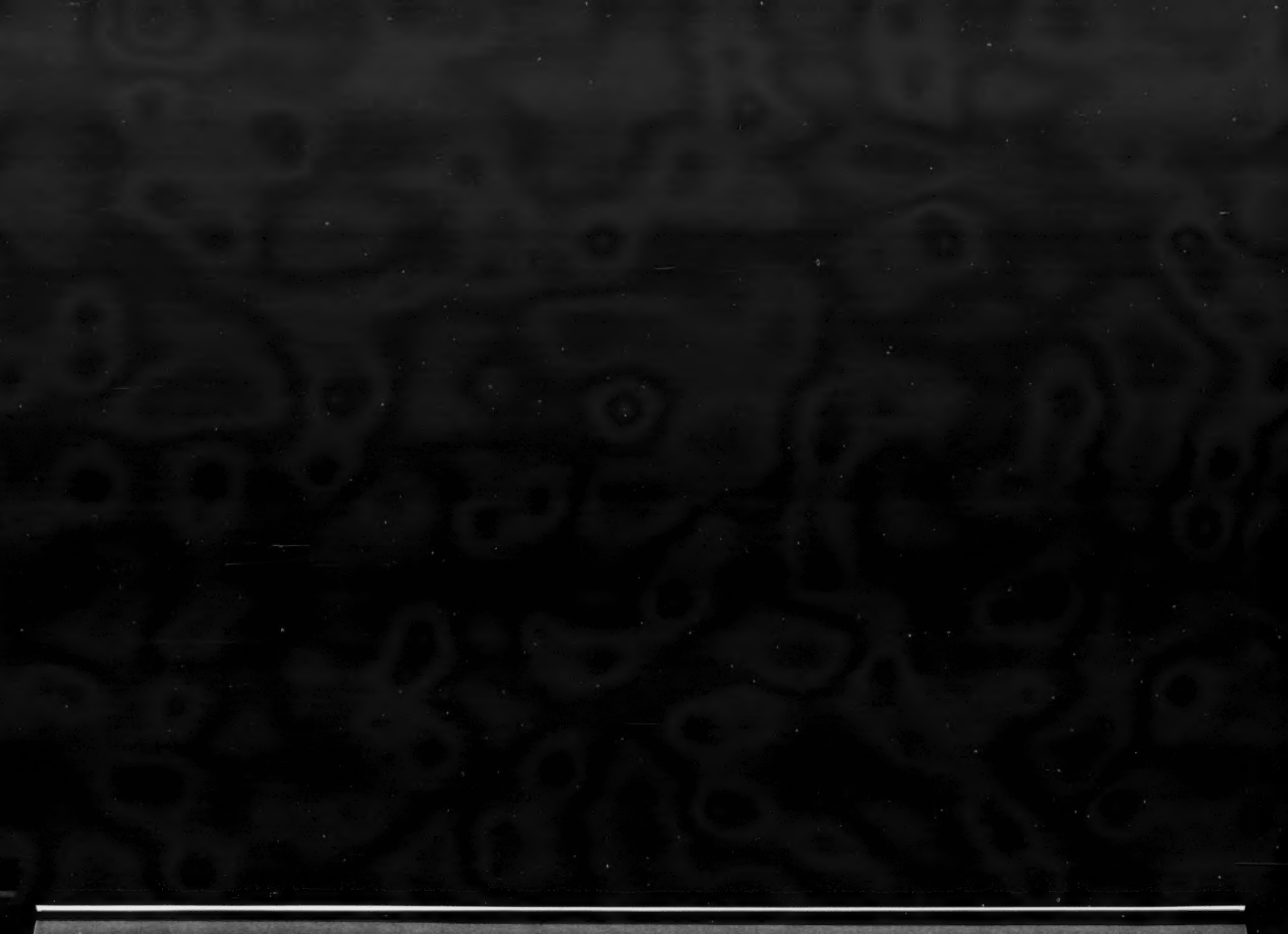


NUCLEAR SCIENCE ABSTRACTS

Volume 10 August 15, 1956 No. 15 Suppl.

# BIOLOGY AND MEDICINE

**5081** AECD-4070
Chicago. Univ. Metallurgical Lab.
THE QUANTITATIVE DETERMINATION OF PLUTONIUM IN BIOLOGICAL MATERIALS. PART II. ANALYSIS OF STOOLS. E. R. Russell and C. Brown. June 13, 1946. Decl. Jan. 10, 1956. 10p. (MUC-ERR-210). $1.80(ph OTS); $1.80(mf OTS).

Methods are described for the determination of Pu excretion rates. All the methods make use of preliminary ashing of samples. The most consistent results were obtained in the T.T.A. and bismuth phosphate procedures. (D.E.B.)

**5082** KAPL-915
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR JANUARY, FEBRUARY, AND MARCH 1953. June 17, 1953. Decl. Jan. 10, 1956. 30p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70 (mf OTS).

Routine personnel, in-plant, and environmental radiation monitoring procedures, and investigations of radiation-hazard incidents engaged in during the period are reported. No indications of serious exposure were found. Design of a unit is reported which may serve as an adequate substitute for a sigma pile in the calibration of neutron detectors. The unit uses water rather than graphite as the moderator and should permit calibrations in the order of 0.1 to 10 times the maximum permissible flux of thermal neutrons. An investigation of the particle collection efficiency of filter papers used in aerosol monitoring and air-cleaning units was begun, and studies of intermediate neutron-monitoring methods, neutron-spectrum evaluations, design of an aerosol sampling unit, and identification of fission products from stack effluent were continued. (C.H.)

**5083** MLM-527
Mound Lab. Miamisburg, Ohio.
BIOLOGICAL RESEARCH REPORT FOR SEPTEMBER 5 TO NOVEMBER 27, 1950. Jan. 2, 1951. Decl. Jan. 10, 1956. 74p. Contract AT-33-1-GEN-53. $12.30(ph OTS); $4.50(mf OTS).

## RADIATION EFFECTS

**5084** BP-97
California. Univ., Berkeley. Radiation Lab.
MEDICAL AND HEALTH PHYSICS SECTION PROGRESS REPORT FOR MAY 1947. Decl. Dec. 13, 1955. 19p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Data are summarized on the deposition of radiolanthanum and promethium in tissues of the rat. The effects of 2,3-dithioglycerol and zirconium citrate on the metabolism of intramuscular Pu were also studied. Some data are given on the bone metabolism of Ra. A study was made of U distribution in mice. Progress in health physics and radiation field studies is discussed. (B.J.H.)

**5085** UCLA-64(Pt. I)
California. Univ. Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1950. Part I. Stafford L. Warren. Apr. 10, 1950. Decl. Jan. 13, 1956. 63p. Contract AT-04-1-Gen-12. $10.80(ph OTS); $3.90(mf OTS).

**5086** UCLA-64(Pt. II)
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1950. Stafford L. Warren. Apr. 1, 1950. Decl. Jan. 12, 1956. 66p. Contract AT-04-1-gen-12. $10.80(ph OTS); $3.90(mf OTS).

**5087** UCLA-250
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1953. Stafford L. Warren. Apr. 10, 1953. Decl. Jan. 13, 1954. 93p. Contract AT-04-1-Gen-12. $15.30(ph OTS); $5.40(mf OTS).

**5088** UCLA-286
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1954. Apr. 1, 1954. Decl. Jan. 14, 1956. 118p. Contract AT-04-1-GEN-12. $18.30(ph OTS); $6.00 (mf OTS).

## RADIATION HAZARDS AND PROTECTION

**5089** KAPL-1116
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR JANUARY, FEBRUARY, MARCH 1954. Decl. Jan. 6, 1954. 34p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

Routine personnel, in-plant, and environmental radiation monitoring procedures and radiation hazards incidents investigated during the period are reported. (C.H.)

Refer also to abstract 5212.

## TOXICOLOGY STUDIES

**5090** AECD-4051
Mound Lab., Miamisburg, Ohio.
BIOLOGICAL RESEARCH [SECTION] QUARTERLY REPORT FOR OCTOBER–NOVEMBER–DECEMBER 1949. Jan. 1, 1950. Decl. with deletions Jan. 11, 1956. 49p. Contract AT-33-1-GEN-53. $7.80(ph OTS); $3.30(mf OTS).

The effects of Po upon the breeding and fecundity of 120 pairs of adult Sprague-Dawley rats were tested by breeding Po-injected animals. The following mating crosses were made: injected females mated with injected males, injected females mated with normal males, normal females mated with injected males, and normal females mated with normal males. It was learned from the results of these crosses that the gestation period of females bred to injected males was increased. From this study it was observed that the ratio of live to stillborn offspring decreased when one or both parents had been injected. There was some evidence that the total number of offspring was increased in the injected female group. (auth)

**5091** M-1974
Rochester, N. Y. Univ. Atomic Energy Project.
MONTHLY PROGRESS REPORT FOR MAY 1947. PART

III, A–G. Pharmacology Report No. 557. Andrew H. Dowdy. May 31, 1947. Decl. Jan. 7, 1956. 71p. Contract W-7401-eng-49. Charge $12.30(ph OTS); $4.50 (mf OTS).

## CHEMISTRY

**5092** A-213
Brown Univ., Providence.
SILICIC ACID PLUGS. Charles A. Kraus. Aug. 7, 1942. Decl. Jan. 13, 1956. 9p. Contract OEMSR-290. (BT-4). $1.80(ph OTS); $1.80(mf OTS).

The rate of flow of water through silicic acid plugs of electrolytic cells was found to obey the following laws: (1) inversely proportional to the thickness of the plug and directly proportional to the hydrostatic pressure; (2) decreases with decreasing temperature of the plug and liquid, and is directly proportional to the fluidity of the liquid; (3) approximately a linear function of particle diameters between 0.001 and 0.003 inches; for larger particles the flow rate deviates from linearity. The effective electrical cross-sectional area increases slightly with decreasing particle size, and is independent of temperature. (L.M.T.)

**5093** AECD-3877
Brookhaven National Lab., Upton, N. Y.
INTERIM REPORT OF THE FUEL PROCESSING GROUP. D. W. Bareis. Jan. 15, 1952. Decl. Dec. 12, 1955. 13p. $3.30(ph OTS); $2.40(mf OTS).

Included are results of studies of the rare earth distribution in bismuth–fused chloride melts, corrosion by bismuth–uranium and fused chloride systems and studies of fused chloride behavior. (B.J.H.)

**5094** AECD-3964
[Clinton Labs., Oak Ridge, Tenn.]
INTERFACIAL TENSION MEASUREMENTS ON $Al(NO_3)_3$–$H_2O$–$HNO_3$–DIBUTYL CELLOSOLVE SYSTEM. E. H. Turk. Jan. 28, 1947. Decl. Dec. 21, 1955. 9p. (CL-FTM-18). $3.30(ph OTS); $2.40(mf OTS).

**5095** AECD-4028
Ames Lab., Ames, Iowa.
SEMI-ANNUAL PROGRESS REPORT IN CHEMISTRY FOR THE PERIOD OCTOBER 1, 1950–MARCH 31, 1951. F. H. Spedding, C. A. Goetz, C. V. Banks, F. R. Duke, V. A. Fassel, E. I. Fulmer, M. Griffel, R. S. Hansen, D. S. Martin, Jr., W. K. Plucknett, R. E. Rundle, H. Shull, H. J. Svec, and A. F. Voigt. May 1, 1951. Decl. with deletions Jan. 4, 1956. 63p. Contract W-7405-eng-82. $10.80(ph OTS); $3.90(mf OTS).

**5096** BC-27
California. Univ., Berkeley. Radiation Lab.
RECOVERY OF URANIUM FROM ALPHA-II CALUTRON EQUIPMENT. Paper No. 14. Manfred E. Mueller. [nd]. Decl. Jan. 18, 1956. 49p. $7.80(ph OTS); $3.30(mf OTS).

Recovery studies made with Alpha-II Calutron equipment and a study made of the Alpha-I/5 Liner at Berkeley are described. Mention is made of subsequent work done in the Alpha-II plant in the Y-12 area at Oak Ridge. It is shown that it is possible to account for 97.5 ± 1.2% of the U input in a series of 12 runs. The chemical recovery alone averaged 94.5%. The equipment consisted of one calutron tank, two sources, two liners, and two collectors. Descriptions of the equipment, the chemistry of the substances involved, and the methods employed for recovery are given in detail. The use of beta-count surveys for establishing the extent of the variation of the equipment and for accounting for a small amount of the total U is described, and a complete discussion of uncertainties and errors is included. (auth)

**5097** CC-1500
[Ames Lab., Ames, Iowa.]
CHEMICAL RESEARCH: GENERAL CHEMISTRY REPORT FOR PERIOD OF APRIL 10 TO MAY 10, 1944. May 30, 1944. Decl. Dec. 13, 1955. 12p. $3.30(ph OTS); $2.40(mf OTS).

**5098** CK-1526
Ames Lab., Ames, Iowa.
CHEMICAL RESEARCH – PURIFICATION OF Pu AND U. Report for Period of Feb. 1 to Mar. 10, 1944. Mar. 29, 1944. Decl. Dec. 19, 1955. 25p. (A-2204). $4.80(ph OTS); $2.70(mf OTS).

**5099** ISC-72
Ames Lab., Ames, Iowa.
PHYSICAL AND INORGANIC CHEMISTRY (GROUPS II, III, AND IV) PROGRESS REPORT [FOR] MAY 1, 1949 TO OCTOBER 31, 1949. W. K. Plucknett, R. S. Hansen, and F. R. Duke. Feb. 6, 1950. Decl. Jan. 10, 1956. 8p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Studies are reported on the separation of Zr and Hf using silica gel and solvent extraction, and the heterogeneous disproportionation of $MnO_4^{2-}$. (K.S.)

**5100** ISC-285
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR APRIL, MAY AND JUNE 1952. Sept. 20, 1952. Decl. Jan. 6, 1956. 31p. Contract W-7405-eng-82. $4.80 (ph OTS); $2.70(mf OTS).

Progress is briefly reported on the following studies: separation of the rare earths by ion exchange, thermochemistry of the rare earths, electrochemistry of the rare earths, adsorption from solution by metals, reactions of $CeCl_4$, determination of trace Al in Th, design of excitation stand for spectrographic analysis, solvent extraction of Ru complexes, and structures of electron-deficient compounds. (T.W.S.)

**5101** KLX-61
Kellex Corp., New York.
MEASUREMENT OF $H^+$ CONCENTRATION AND OXIDATION AND REDUCTION POTENTIALS OF RADIOACTIVE FLUIDS. Detailed Project Status Report. Job 11. Sept. 9, 1949. Decl. Jan. 11, 1956. 25p. Contract AT-30-1-Gen-169. $4.80(ph OTS); $2.70(mf OTS).

Information on the general stability of glass electrodes was obtained. (L.M.T.)

**5102** MonT-223
[Clinton Labs., Oak Ridge, Tenn.]
THE PREPARATION OF RUTHENIUM TRACER FROM WASTE METAL SOLUTION. A. T. Gresky. Dec. 3, 1946. Decl. Jan. 10, 1956. 12p. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

The separation and purification of Ru by distillation of $RuO_4$ has been applied to waste metal solutions. Physical and chemical properties of Ru are summarized. (auth)

**5103** ORNL-65
Oak Ridge National Lab., Tenn.
REPORT OF THE CHEMISTRY DIVISION FOR THE MONTHS MARCH, APRIL, [AND] MAY 1948. E. H. Taylor. June 16, 1948. Decl. Jan. 13, 1956. 187p. Contract W-35-058-eng-71. $30.30(ph OTS); $8.70(mf OTS).

The hydrolytic behavior of $Ce^{4+}$ was investigated. The solvent extraction of Pa from fluoride solutions containing Al by diisopropyl carbinol is described. Investigations were continued on Ru extraction, complexing of U and Np in hexone, and solid formation in U recovery from irradiated slugs. The half life of $Xe^{135}$ was found to be 15.3

min. The loss of Xe during $PdI_2$ precipitation is estimated. Rare-earth fission products were separated from Pu and Am by cation exchange. The recovery of $Ru^{106}$ and $Cs^{137}$ from metal waste supernates and the separation of rare earth fission products are described. Carbon$^{14}$ recovery from irradiated $Be_3N_2$ and synthesis $C^{14}$-labeled organic compounds were investigated. Radioactivity, distribution coefficients, and separation of fission products were also investigated. The radiolysis of $H_2O$ and aqueous solutions was studied. Phase studies of the $UO_2SO_4-H_2O$ system and x-ray analysis of $RuO_2$ and BeO crystals are reported. New analytical procedures and developments in instrumentation are outlined. (C.W.H.)

**5104** TID-271

Technical Information Service, AEC.

CHEMISTRY AND CHEMICAL TECHNOLOGY. Reports from Session V, General Information Meeting October 24, 25, 26, 1949, Oak Ridge, Tenn. 59p. $7.80(ph OTS); $3.30(mf OTS).

Topics discussed at this meeting include: the precision of the fluorimetric determination of U; optical properties of phosphors; the extraction of $Th(NO_3)_4$ into tributyl phosphate–hexone solutions; the hydrolytic behavior of metal ions; anion exchange studies; design of an autotitrator; and the history of the analytical-control program at Y-12. (C.H.)

**5105** UCRL-2069

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1952. Dec. 31, 1952. Decl. Jan. 13, 1956. 69p. Contract W-7405-eng-48. $10.80(ph OTS); $3.90(mf OTS).

Refer also to abstracts 5265 and 5268.

## ANALYTICAL PROCEDURES

**5106** A-2907

National Bureau of Standards, Washington, D. C.

A SYSTEM OF METHODS FOR THE SPECTROCHEMICAL ANALYSIS OF URANIUM-BASE MATERIALS. Bourdon F. Scribner and Harold R. Mullin. Sept. 14, 1945. Decl. Jan. 3, 1956. 110p. $15.30(ph OTS); $5.70(mf OTS).

Spectrochemical methods for the analysis of U-base materials at the NBS are summarized. (K.S.)

**5107** AECD-3889

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIOCHEMICAL ANALYSES FOR Fe, Cr, Ni, AND Co CORROSION PRODUCTS. R. R. Smith, T. O. Passell, and S. D. Reeder. Sept. 9, 1955. Decl. with deletions Jan. 5, 1956. 14p. Contract AT(10-1)-205. $3.30 (ph OTS); $2.40(mf OTS).

Radiochemical and carrier techniques applied to the determination of minute amounts corrosion products of Inconel gave results as follows: Fe, 0.061%; Cr, 0.15%; Ni, 0.037%; and Co, 0.0005%. Step–by–step procedures are given. (L.M.T.)

**5108** AECD-4030

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

A PRECISE POTENTIOMETRIC TITRATION METHOD FOR THE DETERMINATION OF URANIUM. F. S. Voss and R. E. Greene. Aug. 25, 1953. Decl. with deletions Nov. 3, 1955. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A precise potentiometric method for the determination of U in essentially pure U oxides is described. Ten gram samples of oxides are reduced in a Jones reductor and titrated potentiometrically to $U^{+4}$ using Pt and W electrodes. A weighed amount of solid Bureau of Standards $K_2Cr_2O_7$ is then used to oxidize at least 99% of the $U^{+4}$ ion, and the oxidation is completed by titration with 0.01 N $K_2Cr_2O_7$ using calomel and Pt electrodes. This method, which is based on a primary chemical standard, has a precision of ±0.015% on a single determination at the 95% confidence interval. (auth)

**5109** CC-1517

[Ames Lab., Ames, Iowa]

CHEMICAL RESEARCH—ANALYTICAL CHEMISTRY REPORT FOR PERIOD OF FEBRUARY 1 TO MARCH 10, 1944. Apr. 13, 1944. Decl. Dec. 14, 1955. 19p. Contract [W-7405-eng-82]. (A-2096). $3.30(ph OTS); $2.40(mf OTS).

Procedures for the analysis of uranium bromides and chlorides are reported and determination of F in $UF_4$ is given. Critical and detailed procedures are given for the spectrographic analysis of Mg for B, Cd, and Mn. (J.E.D.)

**5110** CC-2934

Ames Lab. Ames, Iowa.

ANALYSIS OF URANIUM-NICKEL ALLOYS. Problem Assignment No. 7. R. P. Ericson. June 7, 1945. Decl. Dec. 15, 1955. 4p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Methods for determination of both U and Ni in solutions of these metals are described. Alloys can be dissolved in $HNO_3$ treated with citric acid to complex the U, and the Ni precipitated as Ni dimethylglyoxime. The U is reduced and titrated with standard ceric sulfate. These methods are for the determination of macro amounts of U and Ni with errors on the order of 0.1%. (auth)

**5111** CC-2941

Ames Lab., Ames, Iowa.

THE SPECTROGRAPHIC ANALYSIS OF BERYLLIUM. Problem Assignment No. 7. A. Lee Smith. June 22, 1945. Decl. Dec. 15, 1955. 6p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Spectrographic procedures for determining small amounts of the common contaminants in beryllium metal and its compounds are described. Suggestions relative to the preparation of synthetic standards are also given. (auth)

**5112** CC-3244

[Ames Lab., Ames, Iowa]

ANALYSIS OF $Th(NO_3)_4-Ca(NO_3)_2-NHO_3$ SOLUTIONS. Problem Assignment No. 117. J. C. Warf, J. H. Patterson, and C. V. Banks. Dec. 20, 1945. Decl. Dec. 15, 1955. 18p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

$Th(NO_3)_4$ is purified by extraction with methyl isobutyl ketone (hexone) from a $HNO_3$ solution containing $Ca(NO_3)_2$ as salting-out agent. Rapid analytical methods were desired for routine control. The most satisfactory method for Th was precipitation of Th molybdate, which is dissolved in acid, passed through a Jones reductor, and titrated. Ca is precipitated as the oxalate. Detailed methods are given for various stages of the Th purification, and methods that were not successful are described briefly. (G.Y.)

**5113** KAPL-755

Knolls Atomic Power Lab., Schenectady, N. Y.

ANALYSIS OF HYDROGEN–DEUTERIUM MIXTURES BY THE THERMAL CONDUCTIVITY METHOD. F. K. Heumann. June 9, 1952. Decl. Dec. 6, 1955. 34p. Contract W-31-109-Eng-52. $0.20(OTS).

The thermal conductivity method for the analysis deuterium in deuterium–hydrogen mixtures has been investigated using a Gow-Mac Model 60-S, flow-type thermal

conductivity cell. The accuracy has been demonstrated to be within ±0.05% compared with that of a mass spectrometer. A study was made of the variables involved which may cause errors in the analysis. These variables include the effect of equilibration of the hydrogen–deuterium mixtures, of certain gaseous impurities, and of variations of the bridge current, sample pressure, and flow rate. (auth)

**5114** KLX-58
Kellex Corp., New York.
PROCESS ANALYTICAL METHODS I: A LITERATURE SURVEY. Detailed Project Status Report. Job 11. Aug. 23, 1949. Decl. Jan. 10, 1956. 23p. Contract AT-30-1-GEN-169. $4.80(ph OTS); $2.70(mf OTS).

The analysis of process streams for U was studied by microwave absorption and fluorimetric methods. The latter procedure was found most suitable, and associated work on the operation of phototubes in high radiation fields and the phenomenon of phototube fatigue was conducted. (K.S.)

**5115** LA-303
[Los Alamos Scientific Lab., N. Mex.]
SPECTROPHOTOMETRIC DETERMINATION OF SUB-MICROGRAM AMOUNTS OF BORON. C. F. Metz. June 7, 1945. Decl. Jan. 26, 1956. 38p. $6.30(ph OTS); $3.00 (mf OTS).

The spectrophotometric determination of microgram quantities of boron, based on the reaction of curcumin with boric acid, is described. The optical density of the complex is measured at 540 mμ. (C.W.H.)

**5116** M-1379
Du Pont de Nemours (E. I.) and Co. Jackson Lab., Wilmington, Del.
DETERMINATION OF OA [HF] CONTENT OF C-616 [$UF_6$] BY FREEZING POINT MEASUREMENT. Problem Report JWD-32. C. W. Maynard, Jr. Oct. 31, 1944. Decl. Jan. 9, 1956. 7p. Contract W-7412-eng-151. $1.80(ph OTS); $1.80(mf OTS).

The technique was found to be in general agreement with measurements made by other methods. (K.S.)

**5117** M-2783
[Manhattan District, Oak Ridge, Tenn.]
[COLORIMETRIC DETERMINATION OF NICKEL AND IRON IN URANIUM AND IN URANIUM FLUORIDES.] [1944]. Decl. Jan. 10, 1956. 11p. $3.30(ph OTS); $2.40 (mf OTS).

**5118** M-4240
Princeton Univ., N. J. Frick Chemical Lab.
THE ESTIMATION OF METAL CONTENT BY HYDROGEN EVOLUTION. APPLICATION TO METALLIC URANIUM AND MAGNESIUM. N. H. Furman and E. L. Stanley. Revised May 1947. Decl. Dec. 5, 1955. 6p. $1.80(ph OTS); $1.80(mf OTS).

**5119** ORNL-300
Oak Ridge National Lab., Tenn.
CHEMISTRY OF PROTACTINIUM III. A METHOD OF ANALYSIS OF ORE RESIDUES FOR PROTACTINIUM. Kurt A. Kraus and Allan Garen. Mar. 15, 1949. Decl. Jan. 6, 1956. 7p. Contract W-7405-eng-26. $1.80 (ph OTS); $1.80(mf OTS).

A rapid method for the analysis of ore residues for $Pa^{231}$ is described. The procedure involves HF leach of the residue, zirconium iodate precipitation, solvent extraction and differential α-range analysis. (auth)

**5120** TID-5242
[Chicago. Univ. Metallurgical Lab.]
MISCELLANEOUS SPECTROCHEMICAL PROCEDURES. Mark Fred, Frank S. Tomkins, Leonard W. Niedrach, and Irene Corvin. [1945?]. TIS issuance date Nov. 1954. Decl. Jan. 13, 1956. 26p. (MUC-FTS-12). $4.80(ph OTS); $2.70(mf OTS).

Procedures for the spectrochemical analysis of solutions by the Cu spark and porous graphite methods are presented. Methods are included for the spectrochemical analysis of $Al_2O_3$ by the pyroelectric concentration method; spectrochemical determination of Nb, Zr, and La in refractory oxi[illegible] small amounts of Ta in Nb by the tannin concentration method; and qualitative spectrochemical analysis. (C.H.)

**5121** Y-226
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
MASS ANALYSIS OF URANIUM ISOTOPES BY EMISSION SPECTROSCOPY. D. D. Smith and L. E. Burkhart. March 4, 1948. Decl. Dec. 6, 1955. 33p. Contract W-7405-Eng-26. $0.25(OTS).

The isotopes of uranium exhibit slightly different emission spectra. Certain uranium lines separate steadily as the concentration of $U^{235}$ increases, which offers a method of assay by simply measuring the distance between two lines. The intensity of a characteristic $U^{235}$ line relative to the intensity of a $U^{238}$ line increases as the concentration of $U^{235}$ increases, providing another method of isotope analysis. Samples for analysis may be chemically impure and contain as little as one microgram of $U_3O_8$. The data show the accuracy and reproducibility of each method. (auth)

**5122** Y-395
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
DETERMINATION OF PHOSPHATE IN THE PRESENCE OF FLUORIDES AND URANIUM. Roberta L. McCutchen and C. D. Susano. Apr. 20, 1949. Decl. July 6, 1955. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Analytical determinations of phosphate (in the presence of uranium and fluorides) by means of colorimetric, volumetric, and gravimetric methods were evaluated in terms of processing time and accuracy. The colorimetric method was found to be superior and is recommended for use in the analysis of uranyl ammonium phosphate samples. Tables and figures are given to substantiate this recommendation. (auth)

Refer also to abstracts 5212, 5220, and 5221.

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

**5123** CC-2947
Iowa State Coll., Ames.
CRYSTAL STRUCTURES OF SOME URANIUM COMPOUNDS. A Summary From The Ames Laboratory. R. E. Rundle, N. C. Baenziger, and A. S. Wilson. Aug. 15, 1945. Decl. Dec. 15, 1955. 9p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Structural data on 44 different chemical and intermetallic compounds of U are collected. (G.Y.)

**5124** CT-2721
Ames Lab., Ames, Iowa.
THE X-RAY STRUCTURES OF $UAl_2$ AND $UAl_3$. Problem Assignment No. 10. R. E. Rundle. May 10, 1945. Decl. Dec. 14, 1955. 9p. Contract W-7405-eng-82. $1.80 (ph OTS); $1.80(mf OTS).

**5125** CT-2946
Iowa State Coll., Ames.
THE URANIUM–MOLYBDENUM BINARY SYSTEM. Donald Ahmann, A. I. Snow, and A. S. Wilson. July 1945. Decl. Dec. 15, 1955. 26p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

## DEUTERIUM AND DEUTERIUM COMPOUNDS

**5126** BNL-118
Brookhaven National Lab., Upton, N. Y.
PROGRESS REPORT OF THE CHEMISTRY DEPARTMENT. Concentration of Deuterium by Chemical Exchange Processes. Interim Report for April 15–July 1, 1951. Jacob Bigeleison, Norman Elliott, Lewis Friedman, A. P. Irsa, Arthur Kant, Morris L. Perlman, and Herbert C. Prosser. Aug. 1951. Decl. Jan. 5, 1956. 20p. Contract [AT-30-2-gen-16]. $0.20(OTS).

Equilibrium in the reaction $NH_{3(g)} + HD_{(g)} \rightleftharpoons NH_2D_{(g)} + H_{2(g)}$ was measured in the temperature range 210 to 295°K. The zero point energy difference between $NH_3$ and $NH_2D$ is calculated. Calculations show that the $NH_3$–HD exchange is 6 times as efficient as the HDS–$H_2O$ exchange under proposed plant operating conditions. Data are included on the effect of various contacting conditions on the exchange of $D_2$ between hydrogen and liquid $NH_3$ catalyzed by $KNH_2$. (L.M.T.)

**5127** M-3132
Du Pont de Nemours (E. I.) & Co. Morgontown Ordnance Works, Morgantown, W. Va.
ELECTROLYTIC P-9 PRODUCTION OPERATING MANUAL. W. M. Harty. Sept. 1, 1945. Decl. Jan. 12, 1956. 84p. $16.80(ph OTS); $5.70(mf OTS).

Operating procedures for the concentration of $D_2O$ and eventual production of 99.8% $D_2$ are outlined. (L.M.T.)

**5128** NYO-7522
Esso Research and Engineering Co., Linden, N. J.
DEUTERIUM SEPARATION STUDY. DISTILLATION OF AMMONIA AND OF METHANE. Progress Report No. 3 [on HEAVY WATER MANUFACTURE SURVEY]. William P. Drews. Oct. 4, 1955. Decl. Jan. 12, 1956. 22p. Contract [AT(30-1)-1407]. (SOA-186).

Attached to this report is a letter containing pertinent data to Morris Goldberg from Frank T. Barr. Oct. 4, 1955. 3p. (SOA-185). $4.80(ph OTS); $2.70(mf OTS).

An evaluation of the distillation-type process for the production of heavy water is presented. Neither ammonia nor methane distillation appears to be economically feasible. (C.W.H.)

Refer also to abstract 5224.

## FLUORINE AND FLUORINE COMPOUNDS

**5129** A-2555
Du Pont de Nemours (E. I.) and Co., Jackson Lab., Wilmington, Del.
DEVELOPMENT OF SHIPPING CYLINDERS FOR C-216 [$F_2$]. Problem Report JWD-43. J. F. Froning and M. K. Richards. Jan. 20, 1945. Decl. Jan. 18, 1956. 13p. Contract W-7412-eng-151. $3.30(ph OTS); $2.40(mf OTS).

Nickel and steel cylinders were evaluated for use in shipping fluorine under pressure. Data are summarized. (C.H.)

**5130** A-2557
Du Pont de Nemours (E. I.) and Co. Jackson Lab., Wilmington, Del.
PLANT FOR PACKAGING FIFTEEN POUNDS C-216 [$F_2$] PER DAY BY THE LIQUEFACTION METHOD. Problem Report JWD-45. J. F. Froning and M. K. Richards. Jan. 20, 1945. Decl. Jan. 18, 1956. 16p. Contract W-7412-eng-151. $4.80(ph OTS); $2.70(mf OTS).

Design features are described of facilities for packaging approximately 15 lb/day of fluorine. The physical and chemical properties of the gas demand extreme attention to details of construction, operation, and maintenance. These details are discussed. (C.H.)

**5131** A-3608
Carbide and Carbon Chemicals Corp., Oak Ridge, Tenn.
PREPARATION OF PURE $C_7F_{14}$ BY FRACTIONAL DISTILLATION OF $C_7F_{14}$ FORESHOT. F. H. Max Nestler, J. R. Hendrickson, T. E. Zava, and A. Alfano. July 22, 1946. Decl. Jan. 18, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

The isolation of $C_7F_{14}$ from the $C_7F_{14}$ foreshot (top fraction resulting from the purification of $C_8F_{16}$) by fractional distillation is described. Two isomeric fluorocarbons were separated in the temperature range 71 to 76°C. (C.W.H.)

**5132** M-875
Du Pont de Nemours (E. I.) and Co. Jackson Lab., Wilmington, Del.
OPERATION OF EXPERIMENTAL C-216 [$F_2$] UNIT (NICKEL ANODES) IN SEMI-WORKS. Problem Report JWD-15. R. C. Downing. Apr. 18, 1944. Decl. Jan. 7, 1956. 18p. Contract W-7412-eng-151. $3.30(ph OTS); $2.40(mf OTS).

Operating data for the $F_2$ semi-works production cell are reported. Results of corrosion testing of construction materials indicate that Monel is very resistant to fluorine corrosion. (C.W.H.)

**5133** M-1320
Du Pont de Nemours (E. I.) and Co. Jackson Lab., Wilmington, Del.
THE REACTION OF HF WITH SODIUM FLUORIDE–THE DESORPTION OF HF FROM SODIUM ACID FLUORIDE. S. G. Turnbull, Jr. May 25, 1944. Decl. Jan. 11, 1956. 15p. Contract W-7412-eng-9. (JWD-25). $3.30(ph OTS); $2.40(mf OTS).

The rate of reaction of NaF with HF has been determined for the temperature range 25 to 150°C and the vapor pressure of HF over $NaHF_2$ has been measured for the range 225 to 275°C. Hydrogen fluoride is removed from $NaHF_2$ by heating $NaHF_2$ to a minimum temperature of 300°C while sweeping with an inert gas. (auth)

## GRAPHITE

**5134** IDO-16232
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NRX GRAPHITE. E. Fast. Oct. 20, 1954. Decl. Jan. 5, 1956. 5p. Contract AT(10-1)-205. (MTRL-54-99). $1.80(ph OTS); $1.80(mf OTS).

Radiation damage studies were made on a graphite sample taken from a thermal column in the NRX Reactor. It was concluded that differences in apparent exposures from stored energy and x-ray measurements of the sample were due in part to the irradiation temperature in the reactor. (C.W.H.)

**5135** N-1570
[Chicago. Univ. Metallurgical Lab.]
DIFFUSION OF HELIUM THROUGH GRAPHITE. R. A. Penneman. Sept. 15, 1944. Decl. Jan. 11, 1956. 4p. Contract [W-7401-eng-37]. (MUC-MB-283). $1.80(ph OTS); $1.80(mf OTS).

**5136** NAA-SR-23
North American Aviation, Inc., Los Angeles.
RESULTS OF PULSE-ANNEALING MEASUREMENTS ON THE ELECTRIC RESISTIVITY OF IRRADIATED GRAPHITE. W. E. Parkins, J. M. Nuding, and D. T. Eggen. October 17, 1949. Decl. Dec. 6, 1955. 28p. Contract AT-11-1-Gen-8. $0.25(OTS).

Improvements are described in the experimental technique of measuring electric resistivity changes in irradiated graphite by pulse-annealing. Results of annealing measurements up to about 2000°C are given for graphite subjected to short exposures on a cyclotron and to a wide range of exposures in a Hanford reactor. The dependence of the annealing measurements on the graphite temperature during irradiation and on the length of exposure are discussed. (auth)

**5137** NAA-SR-39
North American Aviation, Inc., Downey, Calif.
THE ELECTRICAL CONDUCTIVITY OF IRRADIATED GRAPHITE. PART II. Dwain Bowen. July 24, 1950. Decl. Jan. 13, 1956. 31p. Contract AT-11-1-GEN-8. $4.80(ph OTS); $2.70(mf OTS).

The theory for the electrical conductivity of irradiated graphite was extended to the thermal annealing of radiation damage and to the temperature coefficient of electric resistivity. (C.W.H.)

**5138** NAA-SR-51
North American Aviation, Inc., Los Angeles, Calif.
THE CREEP CHARACTERISTICS OF ECA GRAPHITE. R. D. Keen. Jan. 26, 1950. Decl. Jan. 27, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

The creep characteristics of ECA Graphite under tensile stress at elevated temperatures were measured. The testing temperature ranged from 2200°C to 2900°C, while the applied stress varied from 500 to 5,500 lb/in.$^2$. The range of creep rates measured extended from $3 \times 10^{-8}$ to $2 \times 10^{-4}$ in./in./sec. Activation energy and change in entropy were calculated for the above conditions. (auth)

**5139** NAA-SR-59
North American Aviation, Inc., Los Angeles.
THE THERMAL CONDUCTIVITY OF IRRADIATED GRAPHITE. Dwain Bowen. Apr. 20, 1950. Decl. Dec. 5, 1955. 21p. Contract AT-11-1-GEN-8. $0.20(OTS).

A theory of the electronic thermal conductivity of irradiated graphite is developed. It is found that for unirradiated graphite the Lorenz number (Wiedemann-Franz law for metals) times $T^2$ is a constant. The available experimental data fit this law reasonably well; hence, it may be concluded that the major portion of the thermal conductivity of graphite is electronic. (auth)

**5140** NAA-SR-862
North American Aviation, Inc., Downey, Calif.
LOW TEMPERATURE THERMAL AND ELECTRICAL CONDUCTIVITIES OF NORMAL AND NEUTRON IRRADIATED GRAPHITE. N. S. Rasor and A. W. Smith. June 1, 1954. Decl. Dec. 6, 1955. 37p. Contract AT-11-1-GEN-8. $0.30(OTS).

The thermal and electrical conductivities of a variety of normal and neutron irradiated graphites have been determined at low temperatures. The method employed permits precise property determinations over a large range of property values and temperature. Under certain conditions the thermal diffusivity of a specimen may be determined and illustrative results are presented. Agreement with the results of other workers has been obtained. The striking temperature dependence of the thermal conductivity of graphite is discussed as well as the effect of crystallite size and neutron bombardment on the thermal conductivity curves. (auth)

**5141** NYO-5097
Mallinckrodt Chemical Works, St. Louis.
MOLD DRESSINGS FOR GRAPHITE. William A. Oppold. Mar. 29, 1945. Decl. Jan. 10, 1956. 3p. Contract W-7405-eng-29. $1.80(ph OTS); $1.80(mf OTS).

Different mold dressings for garphite were tried in order to improve the surface of the cast material and prevent the metal from sticking to the graphite. Results reported are: Two parts carbonaceous cement and one part aerosol solution gives a satisfactory dressing; $ZrO_2$ is too dense to make a good mold dressing under the conditions tried; $TiO_2$ gives satisfactory results but is not as hardy a dressing as is desired; and MgO mixed with an aerosol solution gives the best results and a thick mixture rubbed onto the graphite is better than a thin mixture painted on. (C.W.H.)

**5142** TID-5046
Battelle Memorial Inst., Columbus, Ohio.
NOTES ON COMMERCIAL CARBON AND GRAPHITE. J. A. Slyh. Jan. 15, 1952. Decl. Jan. 12, 1956. 6p. $1.80 (ph OTS); $1.80(mf OTS).

Brief note is made of the importance of carbon and graphite parts in the industrial world and in the work of the AEC, and of the considerable amount of study being expended on the material. The more common physical characteristics, and the raw materials and processing operations employed in the fabrication, of many of the commercial grades of the National Carbon Division of the Union Carbide and Carbon Corporation are presented in a table. Typical properties of the carbon and graphite products of the Great Lakes Carbon Corp. and of the International Graphite and Electrode Corp. are also tabulated. (B.J.H.)

Refer also to abstract 5419.

## RADIATION CHEMISTRY

**5143** IDO-26081
Oak Ridge National Lab., Tenn.
A GENERAL DECONTAMINATION MANUAL FOR THE IDAHO CHEMICAL PROCESSING PLANT. C. D. Watson. Mar. 11, 1953. Decl. Dec. 7, 1955. 18p. $3.30(ph OTS); $2.40(mf OTS).

Decontamination procedures are outlined for the removal of radioactive contamination from stainless steel chemical processing equipment, stainless steel laboratory surfaces, concrete surfaces, painted surfaces, asphalt floor tile, and Cu and brass surfaces. Two methods for the destruction of oxalic acid are included. (C.H.)

## RADIATION EFFECTS

**5144** NAA-SR-1288
North American Aviation, Inc., Downey, Calif.
RADIATION STABILITY OF THE TERPHENYLS AND OTHER POLYPHENYL MATERIALS AS MEASURED BY GAS EVOLUTION. Eugene L. Colichman and R. Henry Gercke. June 15, 1955. Decl. Jan. 10, 1956. 22p. Contract AT-11-1-GEN-8. $0.20(OTS).

The terphenyls and several other polyphenyls and mixtures were irradiated with 1-Mev electrons and the gas evolution rate determined as a means of evaluating the radiation stability. The low decomposition rates of the polyphenyls obtained are explained on the basis of a proposed fluorescence-protective mechanism. (C.W.H.)

## RARE EARTHS AND RARE-EARTH COMPOUNDS

**5145** TID-5194
New Brunswick Lab., AEC, N. J.
NEW BRUNSWICK LABORATORY REPORT ON THE THORIUM PROGRAM FOR THE PERIOD ENDING APRIL 11, 1952. Decl. Jan. 13, 1956. 14p. $3.30(ph OTS); $2.40 (mf OTS).

Data are presented on the separation of Th from the rare earths by precipitation with hydrogen peroxide; the distribution of Yb and Y between tributyl phosphate and thorium nitrate–nitric acid solutions; and the separation of Th from its decay products by precipitation methods. (C.H.)

**5146** UCRL-1434(Rev.)
California. Univ., Berkeley. Radiation Lab.
AN ION EXCHANGE STUDY OF POSSIBLE HYBRIDIZED 5f BONDING IN THE ACTINIDES. R. M. Diamond, K. Street, Jr., and G. T. Seaborg. Aug. 28, 1951. Decl. Jan. 12, 1956. 53p. Contract W-7405-eng-48. $9.30 (ph OTS); $3.60(mf OTS).

A study was made of the elution behavior of Cm(III), Am(III), Pu(III), Ac(III), Pu(IV), Np(IV), U(IV), Th(IV), Np(V), Pu(VI), U(VI), La(III), Ce(III), Eu(III), Yb(III), Y(III), Sr(II), Be(II), Ra(II), and Cs(I) with 3.2 M, 6.2 M, 9.3 M, and 12.2 M HCl solutions from Dowex-50 cation exchange resin columns. These elutions show that in high concentrations of hydrochloric acid the actinides form complex ions with chloride ion to a much greater extent than the lanthanides. The strengths of the tripositive actinide complex ions apparently go in the order Pu > Am > Cm, although their ionic radii also decrease in this same order. To explain these results, a partial covalent character may be ascribed to the bonding in the transuranium complex ions. It is shown that a reasonable structure for such covalent bonding involves hybridization of the 5f orbitals in the actinide elements. (auth)

## SEPARATION PROCEDURES

**5147** AECD-3906
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
SOLVENT EXTRACTION. R. H. Smellie, Jr. and D. P. Krause. July 16, 1947. Decl. Dec. 12, 1955. 84p. Contract [W-7405-eng-26]. (B-4-380.216). $13.80(ph OTS); $4.80(mf OTS).

Information is given on the use of a number of organic solvents (pentaether, diethyl ether, dibutyl carbitol, and others) in the extraction of uranium, uranium-organic compounds, and a variety of metallic and non-metallic elements and complexes from aqueous solution. (T.W.S.)

**5148** AECD-3987
Mallinckrodt Chemical Works, St. Louis.
DESIGN OF A BUBBLE-CAP COLUMN TO REPLACE NITRIC ACID CONCENTRATOR. H. Wallingford. Aug. 22, 1949. Decl. with deletions Dec. 2, 1955. 21p. $4.80(ph OTS); $2.70(mf OTS).

**5149** AECD-4026
Vitro Corp. of America, New York.
RECOVERY OF RADIUM FROM K-65 RESIDUE (23-E). Summation Report [for] period March 1950 through September 1950; May 1951 through November 1951. JOB 23. Feb. 12, 1952. Decl. with deletions Nov. 15, 1955. 46p. Contract AT-(30-1)-848. $7.80(ph OTS); $3.30(mf OTS).

Methods for recovering radium from K-65 residue have been investigated. A process using Versene was developed and demonstrated on a laboratory scale. In this process K-65 residue is leached with Versene solution and radium is adsorbed from the leach liquors and purified by the use of cation exchange resin. (auth)

**5150** AECD-4149
Mound Lab., Miamisburg, Ohio.
LIQUID WASTE DISPOSAL RESEARCH QUARTERLY REPORT FOR APRIL 1, 1949 TO JUNE 30, 1949. Frank C. Mead, Jr. July 1, 1949. Decl. with deletions Jan. 20, 1956. 28p. Contract AT-33-1-GEN-53. $4.80(ph OTS); $2.70(mf OTS).

Radiometric procedures have been developed for both routine beta analysis and to determine the radioactive constituents by absorption studies. It is thought that Ru and Cs make up a great portion of the radioactive materials present in the two and one-half year old crib waste. Their presence has been corroborated by absorption studies. A satisfactory method for the quantitative determination of Ru in these solutions has been developed. Initial ion-exchange experiments indicate that it is not practical to use ion-exchange resins for the complete decontamination of crib wastes. Coprecipitation experiments for the removal of ruthenium as the sulfide or complex cyanide show some promise. (auth)

**5151** ANL-4224
Argonne National Lab., Lemont, Ill.
THE SEPARATION OF NEPTUNIUM FROM PLUTONIUM BY A VOLATILIZATION METHOD. Sherman Fried. Nov. 23, 1948. Decl. Dec. 13, 1955. 9p. Contract W-31-109-eng-38. (ANL-WMM-437). $0.15(OTS).

It has proved possible to separate Np from Pu by a volatilization method involving the fractional sublimation of the chlorides. The chlorides are formed by the action of $CCl_4$ vapor at 650°C on the mixed oxides, $PuCl_3$ being formed from the $PuO_2$ fraction and $NpCl_4$ from the $NpO_2$. The large difference in vapor pressures of the two compounds at 450°C (less than $10^{-6}$ mm. for $PuCl_3$ and ca. $10^{-1}$ mm. for $NpCl_4$) permits the separation of the two compounds by fractional sublimation at that temperature. The starting material contained approximately 4% Pu by weight as determined by differential pulse analysis and the final product contained less than $10^{-3}$% (the limit of detection). The separation is thus of the order of $3 \times 10^3$. This process has been carried out on the 100-μg scale up to the 65 mg scale and the yield of usable material obtained in most cases was of the order of 96%. (auth)

**5152** K-493
Carbide and Carbon Chemicals Corp. K-25 Plant. Oak Ridge, Tenn.
PILOT PLANT EVAPORATION OF UAP PROCESS WASTES. J. C. Barton and G. J. Vogel. Aug. 29, 1949. Decl. Jan. 6, 1956. 13p. Contract [W-7405-eng-26]. (KLO-140). $3.30(ph OTS); $2.40(mf OTS).

Radioactive, uranium-free waste from the UAP process was concentrated by evaporation on a pilot plant scale to a volume equal to about 120% of that occupied by the metal waste processed. This concentrated process waste is a saturated solution at approximately 20°C. The maximum allowable radioactivity in solutions discharged through normal sewage channels was tentatively set at 100 disintegrations per minute per milliliter. Evaporator condensate which met this specification was produced by each of two techniques: (1) passage of the condensate from a single–effect evaporator through a cation exchange column, and (2) use of a reflux column on a single–effect evaporator. (auth)

**5153** KAPL-513
Knolls Atomic Power Lab., Schenectady, N. Y.
THE MULTISTAGE PUMP-MIX MIXER SETTLER. B. V. Coplan, J. K. Davidson, J. H. Holmes, and A. C. Schafer. Apr. 21, 1951. Decl. Jan. 5, 1956. 39p. Contract W-31-109-eng-52. $0.25(OTS).

The construction and operation of the small scale, pump-mix unit are described in detail. Data from a typical run, show efficiency, interstage data, and material balances. Some theory of operation is included along with the operating procedure. (auth)

**5154** M-2177
Brown Univ., Providence.
INVESTIGATIONS ON THE DISTRIBUTION OF $UO_2(NO_3)_2$ BETWEEN ORGANIC SOLVENTS AND $H_2O$. "M" Report No. 12. Charles A. Kraus. June 28, 1944. Decl. Jan. 7, 1956. 6p. Contract W-7405-eng-73. (BM-12). $1.80(ph OTS); $1.80(mf OTS).

Results are given of detailed investigations of the partition of $UO_2(NO_3)_2$ between $H_2O$ and dibutyl "Cellosolve" in the presence of $Ca(NO_3)_2$, $Fe(NO_3)_3$, and $Mg(NO_3)_2$. The use of a triether, dibutyl "Carbitol" as an extractant, and the solubility of various ethers in $H_2O$ and $H_2O$ in ether are given. (D.E.B.)

**5155** NYOO-33
New York Operations Office, AEC.
RECOVERY OF URANIUM FROM SEA WATER AND THE SEDIMENTS OF THE OCEAN FLOOR. Stuart R. Schram and Charles Slesser. Aug. 5, 1948. Decl. Dec. 6, 1955. 8p. $1.80(ph OTS); $1.80(mf OTS).

A chemical process of the type employed for Mg for extracting U from sea water appears out of the question, but some special application of adsorption methods might prove valuable. (auth)

**5156** NYO-5193
Mallinckrodt Chemical Works, St. Louis.
SOME OBSERVATIONS ON THE ETHER–NITRIC ACID REACTION. A. S. Tomcufcik. Aug. 12, 1946. Decl. Jan. 6, 1956. 8p. $1.80(ph OTS); $1.80(mf OTS).

Ether and anhydrous $HNO_3$ reacted visibly with the evolution of NO and a simultaneous sharp increase in temperature. Sunlight and peroxides had no effect on the course of the reaction. (C.W.H.)

**5157** NYO-6011
Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.
ELECTROCHEMICAL SEPARATIONS IN NON-AQUEOUS SOLUTIONS. Occasional Report No. 2 for the Period December 1, 1952 to June 1, 1953. G. M. Pound, Henry Perlee, Evangeline Seitanakis, and Earl Roland. June 1, 1953. Decl. Jan. 6, 1956. 38p. Contract AT(30-1)-1432. $6.30 (ph OTS); $3.00(mf OTS).

Thermodynamically calculated and directly measured decomposition potentials for chlorides of reactor fission product metals in molten LiCl–KCl eutectic and in formamide solution are presented. These values indicate that there are sufficient differences between the decomposition potentials of these compounds to permit electrolytic separations of the subject metals. A high-temperature electrolytic cell with separate electrode compartments is described. Decomposition potentials for PbO (0.8 v) and LiCl (3.6 v) were obtained using this cell, and agree fairly well with the thermodynamic values. Directly measured decomposition potentials for $LaCl_3$ and $CeCl_3$ in formamide solution at room temperature are presented. (auth)

**5158** ORNL-330
Oak Ridge National Lab., Tenn.
CHEMISTRY OF PROTACTINIUM. V. SEPARATION OF THORIUM, PROTACTINIUM AND URANIUM WITH ANION EXCHANGE COLUMNS IN HCl SOLUTIONS. Kurt A. Kraus and George E. Moore. Apr. 27, 1949. Decl. Jan. 12, 1956. 9p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

**5159** ORNL-614
Oak Ridge National Lab., Tenn.
DEPOSITION OF RUTHENIUM ON ORGANIC MATERIALS. A. T. Gresky. Apr. 24, 1950. Decl. Jan. 5, 1956. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A means of removing ruthenium activity from fission product solutions was desired for use in chemical separations processes. For this purpose, a simple procedure was developed which utilized oxidation of Ru to the tetroxide at room temperature by para-periodic acid and deposition of ruthenium dioxide from aqueous solutions onto solid organic material. As much as 99.7% Ru removal from tracer solutions was demonstrated using this procedure. (B.J.H.)

**5160** RMO-2707
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] OCTOBER 1952. Nov. 17, 1952. Decl. Nov. 28, 1955. 22p. $3.30(ph OTS); $2.40 (mf OTS).

The beneficiation of leach zone material was studied further in mineral-dressing equipment. Selective grinding of the phosphate to finer size than the quartz and subsequent separation were accomplished by wet-grinding in a rod mill, attrition-grinding in a centrifugal pump, and classification in a hydraulic cyclone. The calcination of leach zone material was studied in small-scale tests to evaluate the factors that effect extraction with acid. Exploratory studies were continued of a process for producing a nitric phosphate fertilizer from Florida leach zone material. Tests are being made to obtain data for use in designing a proposed pilot plant for further development of the process. (J.E.D.)

**5161** RMO-2708
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] NOVEMBER 1952. Dec. 12, 1952. Decl. Nov. 28, 1955. 33p. $4.80(ph OTS); $2.70 (mf OTS).

Study was made of both wet and dry methods for beneficiating leach zone material. The methods were based upon preferential grinding of the phosphate to finer size than the quartz and separation of the two. Tests of several types of mills for dry-grinding the ore led to the conclusion that the rod mill is the most suitable. The temperature of calcination of leach zone material and the rate of cooling were studied in small-scale tests to determine the effects on extraction of $P_2O_3$, U, and $Al_2O_3$ from the calcined ore with nitric acid. The calcination and air quenching of two different lots of ores, V-6 and A-2, under the same conditions resulted in marked differences in extractions. The effect was most pronounced in uranium extractability. Tests in small-scale and pilot-plant equipment are being made to obtain data for use in designing a pilot plant for the production of nitric phosphate fertilizer and recovery of uranium. (J.E.D.)

**5162** RMO-2711
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] FEBRUARY 1953. Mar. 10, 1953. Decl. Nov. 28, 1955. 20p. $3.30(ph OTS); $2.40 (mf OTS).

**5163** RMO-2712
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] MARCH 1953. Apr. 9, 1953. Decl. Nov. 28, 1955. 17p. $3.30(ph OTS); $2.40(mf OTS)

**5164** RMO-2713
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] APRIL 1953. May 18, 1953. Decl. Nov. 28, 1955. 16p. $3.30(ph OTS); $2.40(mf OTS).

**5165** RMO-2714
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] MAY 1953. June 15, 1953. Decl. Nov. 28, 1955. 14p. $3.30(ph OTS); $2.40(mf OTS).

**5166** RMO-2717
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] AUGUST 1953. Sept. 23, 1953. Decl. Nov. 28, 1955. 25p. $4.80(ph OTS); $2.70(mf OTS).

**5167** RMO-2718
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] SEPTEMBER 1953. Oct. 14, 1953. Decl. Nov. 28, 1955. 25p. $4.80(ph OTS); $2.70 (mf OTS).

**5168** RMO-2721
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] DECEMBER 1953. Dec. 29, 1953. Decl. Nov. 28, 1955. 15p. $3.30(ph OTS); $2.40 (mf OTS).

**5169** RMO-2723
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] FEBRUARY 1954. Feb. 25, 1954. Decl. Nov. 28. 1955. 18p. $3.30(ph OTS); $2.40 (mf OTS).

**5170** RMO-2725
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] APRIL 1954. Apr. 29, 1954. Decl. Nov. 28, 1955. 8p. $1.80(ph OTS); $1.80(mf OTS).

**5171** RMO-2728
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] JULY 1954. July 29, 1954. Decl. Nov. 28, 1955. 13p. $1.80(ph OTS); $1.80(mf OTS).

**5172** RMO-2733
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL PROGRESS REPORT [FOR] FEBRUARY 1955. Feb. 25, 1955. Decl. Nov. 28, 1955. 18p. $3.30(ph OTS); $2.40 (mf OTS).

**5173** Y-235
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES [FOR] AUGUST 1948. K. B. Brown, W. R. Grimes, and C. D. Susano. Sept. 7, 1948. Decl. Jan. 16, 1956. 33p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

**5174** Y-279
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF OCTOBER 1948. K. B. Brown, W. R. Grimes, and C. D. Susano. Nov. 10, 1948. Decl. Jan. 16, 1956. 26p. Contract W-7405-Eng-26. $4.80(ph OTS); $2.70(mf OTS).

A study was made of U recovery from oil shales including cascade water leaching of roasted ore, selectivity of various leaching agents on roasted ore, leaching of burned shale, analytical development and recovery of U from leach solutions, precipitation of U with arsenite, caustic washing of phosphate precipitates, hydrolytic precipitation of U, and precipitation with arsenilic acid. (J.E.D.)

**5175** Y-304
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF NOVEMBER 1948. K. B. Brown, W. R. Grimes, and C. D. Susano. Dec. 15, 1948. Decl. Jan. 13, 1956. 18p. Contract W-7405-Eng-26. $3.30(ph OTS); $2.40(mf OTS).

**5176** Y-310
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF DECEMBER 1948. K. B. Brown, W. R. Grimes, and C. D. Susano. Dec. 31, 1948. Decl. Jan. 16, 1956. 27p. Contract W-7405-Eng-26. $4.80(ph OTS); $2.70(mf OTS).

**5177** Y-341
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF JANUARY 1949. K. B. Brown, W. R. Grimes, and C. D. Susano. Feb. 10, 1949. Decl. Jan. 16, 1956. 27p. Contract W-7405-Eng-26. $4.80(ph OTS); $2.70(mf OTS).

**5178** Y-420
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF MAY 1949. K. B. Brown, W. R. Grimes, and C. D. Susano. June 3, 1949. Decl. Jan. 13, 1956. 27p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS)

**5179** Y-446
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
PROGRESS REPORT ON SHALE STUDIES FOR THE MONTH OF JUNE 1949. K. B. Brown, W. R. Grimes, and C. D. Susano. July 7, 1949. Decl. Jan. 16, 1956. 25p. Contract W-7405-Eng-26. $4.80(ph OTS); $2.70(mf OTS).

Refer also to abstracts 5195 and 5211.

## TRANSURANIC ELEMENTS AND COMPOUNDS

**5180** CN-727
Chicago. Univ. Metallurgical Lab.
CHEMICAL RESEARCH—CHEMISTRY OF 94 [Plutonium]. REPORT FOR MONTH ENDING JUNE 15, 1943. [nd]. Decl. Dec. 13, 1955. $1.80(ph OTS); $1.80(mf OTS).

In a study of the properties of metallic Pu using tracer quantities, U containing Pu was alloyed with three other metals, Sn, Bi, and Al. The alloys were broken up by the formation of the hydride and sifted to separate the crystals of intermetallic compound from the hydride. The various fractions were analyzed by the usual methods. Plutonium shows only a very slight tendency to combine with Al as most of it remained with the U in the Al alloy. It combines to a greater extent with Bi, about 30% of the Pu being found with the Bi–U compound. It reacts completely with Sn; most of it separates out with the Sn–U compound, that remaining with the uranium-rich fraction being less than the amount of Sn left in that fraction. Complete separation of the Sn should remove all of the Pu from most of the U. The carrying power of $LaF_3$ for reduced Pu in the presence of Al using 3 and 6N HF has been tested. The carrying begins to drop at 0.2 mg Al/ml and is negligible at 1 mg Al/ml at both these concentrations of HF. Conditions favorable for coagulation of the colloidal precipitate were used. An improvement has been suggested for the dry

fluoride process utilizing the reaction of $UH_4$ with HF to form $UF_4$ rather than conversion to oxide and then to $UF_4$. (auth)

**5181** CN-1656
Clinton Labs., Oak Ridge, Tenn.
DETERMINATION OF IRON IN PRODUCT SOLUTIONS. Progress Report [on] Problem Assignment No. 208-x2A. A. K. Parlour. July 12, 1944. Decl. Jan. 18, 1956. 19p. (A-2670). $3.30(ph OTS); $2.40(mf OTS).

Data are presented to show that plant samples of Pu may be analyzed colorimetrically for Fe by means of orthophenanthroline. Transmittance curves show no serious interference from the following ions when present in the concentrations which are probable for the process solutions to be analyzed: $Zr^{++++}$, $Ni^{++}$, $Cr^{+++}$, $Bi^{+++}$, $La^{+++}$, and $Mn^{++}$. (auth)

**5182** CN-1881
Clinton Labs., Oak Ridge, Tenn.
CONCENTRATION OF PLUTONIUM BY PRECIPITATION OF THE IODATE FROM $La(NO_3)_3$ SOLUTIONS. Progress Report on Problem Assignment No. 213-X40C — INVESTIGATION OF THE CHEMISTRY OF PLUTONIUM. B. A. Fries, comp. Aug. 11, 1944. Decl. Jan. 18, 1956. 19p. (A-2689). $3.30(ph OTS); $2.40(mf OTS).

A procedure is described for the concentration and isolation of Pu from $LaF_3$. The $La(NO_3)_3$ solution obtained from the metathesis of $LaF_3$ is pretreated with $SO_2$ and $La(OH)_3$ and the product precipitated. $Pu(IO_3)_4$ is precipitated directly from the $HNO_3$ solution of the hydroxides with a solubility of less than 5 mg Pu/l; a small amount of $La(IO_3)_3$ precipitates with the $Pu(IO_3)_4$. This precipitate is dissolved in $HNO_3 + SO_2$ and the hydroxides again thrown down and dissolved in $HNO_3$. The Pu(IV) is oxidized and the La(III) separated from the Pu by precipitation as a by-product $LaF_3$. The Pu(VI) is reduced and precipitated as $K_2PuF_6$, which is put into solution by metathesis or $H_2SO_4$-fuming. Use of the above procedure has resulted in an average total loss of about 1%, most of which is easily recoverable. The results of some studies on the solubility of the iodates of Pu(III) and Pu(VI) are presented. (auth)

**5183** LA-70
[Los Alamos Scientific Lab., N. Mex.]
METALLURGY OF PLUTONIUM. L. Levinson, A. U. Seybolt, and J. Zaring. Mar. 15, 1944. Decl. Dec. 13, 1955. 5p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

The hardness of Li-reduced Pu was found to be about 94 as compared to about 200 for unalloyed U. An attempt to vacuum melt Ca-reduced Pu was unsuccessful. (auth)

**5184** MonN-92
[Clinton Labs., Oak Ridge, Tenn.]
PROCEDURE FOR THE DETERMINATION OF PLUTONIUM IN URINE. Problem Assignment CX3-4. M. E. Koshland, L. M. Brown, M. J. Cook, and D. E. Koshland, Jr. May 21, 1946. Decl. Jan. 11, 1956. 28p. Contract W-35-058-eng-71. $4.80(ph OTS); $2.70(mf OTS).

A method was developed for the analysis of Pu in urine. The procedure involves a direct precipitation of $CaC_2O_4$ from urine, oxidation of the oxalate to dissolve the precipitate, a precipitation of $La(OH)_3$ to separate from calcium, and a final precipitation of $LaF_3$. The method gives a yield of 91.7 ± 2.6%; it requires only two transfers and provides adequate separation from U. (auth)

**5185** UCRL-329
California. Univ., Berkeley. Radiation Lab.
EQUILIBRIA IN THE OXIDE SYSTEMS OF PRASEODYMIUM AND AMERICIUM. L. B. Asprey and B. B. Cunningham. Apr. 14, 1949. Decl. Dec. 8, 1955. 36p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The thermal decomposition of the higher oxides of praseodymium and americium have been investigated. The decomposition of $PrO_{1.833}(Pr_6O_{11})$ to $PrO_{1.5}(Pr_2O_3)$ was accomplished and a value of 47 ± 5 kcals for the heat of the reaction obtained. The reaction proved to be very complex. The decomposition of $AmO_2$ was carried out only to $AmO_{1.85}$ due to the greater stability of $AmO_2$. It was impossible to extend the value of 21 kcals obtained for the partial heat of the reaction to obtain a value for the decomposition to $AmO_{1.5}$. The composition of the higher oxide was shown to be $AmO_{1.98 \pm 0.02}$. (auth)

## TRITIUM AND TRITIUM COMPOUNDS

**5186** HW-17318
Hanford Works, Richland, Wash.
P-10 CHEMICAL EQUILIBRIA. W. C. Roesch. Mar. 23, 1950. Decl. Jan. 12, 1956. 4p. $1.80(ph OTS); $2.40(mf OTS).

Information is briefly noted on equilibria of $T_2 - H_2O$ and $HT - H_2O$ exchange reactions. (T.W.S.)

## URANIUM AND URANIUM COMPOUNDS

**5187** A-494
National Bureau of Standards, Washington, D. C.
DETERMINATION OF THE CHLORINE–OXYGEN RATIO IN THE COUNTER-CURRENT ELECTROLYSIS OF URANYL CHLORIDE SOLUTIONS. Walter J. Hamer. [Mar. 27, 1943]. Decl. Jan. 13, 1956. 23p. $4.80(ph OTS); $2.70(mf OTS).

The current efficiency for the production of $Cl_2$ by the electrode materials Pt, Pd, Ir, Pt-Ir alloy, magnetite, ZrC, $W_2C$, Nb-TaC, and graphite were tested at various current densities, and Pt-group electrode materials were found to be most suitable. (K.S.)

**5188** A-2309
Brown Univ., Providence.
PRELIMINARY INVESTIGATION EMPLOYING A ROTATING KILN FOR THE PREPARATION OF $RF_4$ [$UF_4$] BY REACTION OF $RO_3$ [$UO_3$] AND "FREON-114" ($C_2F_4Cl_2$) AT ELEVATED TEMPERATURES. Charles A. Kraus. Mar. 24, 1945. Decl. Jan. 17, 1956. 6p. Contract W-7405-eng-73. (BT-48). $1.80(ph OTS); $1.80(mf OTS).

**5189** A-2313
Brown Univ., Providence.
PREPARATION OF $RCl_4$ [$UCl_4$] BY VAPOR PHASE CHLORINATION OF $RO_2$ [$UO_2$] FORMED BY REDUCING $RO_3$ [$UO_3$] WITH ETHANOL. Charles A. Kraus. July 12, 1945. Decl. Jan. 17, 1956. 11p. Contract W-7405-eng-73. (BT-52). $3.30(ph OTS); $2.40(mf OTS).

A reactive form of $UO_2$, suitable for preparing $UCl_4$ by vapor phase chlorination with $CCl_4$ or $SOCl_2$, may be formed by reducing $UO_3$ (from $UO_4$) with $C_2H_5OH$ vapor. With $CCl_4$ as chlorinating agent the per cent nonvolatile U (as $UO_2$) in the products averages 1% or less, with $SOCl_2$, between 0.2 and 0.1%. The time cycle for the chlorination should be 5 hr or less. (auth)

**5190** A-2319
Brown Univ., Providence.
INFLUENCE OF SALT IMPURITIES ON THE CALCINATION OF $RO_4$ [$UO_4$] TO $RO_3$ [$UO_3$]. Charles A. Kraus. Aug. 27, 1945. Decl. Jan. 17, 1956. 8p. Contract W-7405-eng-73. (BT-58). $1.80(ph OTS); $1.80(mf OTS).

The effect of impurities in $NH_4NO_3$, $NaNO_3$, and $Ca(NO_3)_2$ on the conversion of hydrated $UO_4$ to $UO_3$ by calcination was investigated. Data are tabulated. (C.H.)

**5191** A-2322
Brown Univ., Providence.
INFLUENCE OF TEMPERATURE ON THE EXTRACTION OF $RO_2(NO_3)_2$ [$UO_2(NO_3)_2$] BY POLYETHERS. REPORT NO. 1, $Ca(NO_3)_2$ AND $Al(NO_3)_3$ AS SALTING OUT AGENTS AND DIBUTYL "CARBITOL" AS EXTRACTION AGENT. Charles A. Kraus. Sept. 27, 1945. Decl. Jan. 17, 1956. 14p. Contract W-7405-eng-73. (BT-61). $3.30(ph OTS); $2.40(mf OTS).

**5192** A-2323
Brown Univ., Providence.
INFLUENCE OF TEMPERATURE ON THE EXTRACTION OF $RO_2(NO_3)_2$ [$UO_2(NO_3)_2$] BY POLYETHERS. REPORT NO. 2. $Cu(NO_3)_2$ AND $Fe(NO_3)_3$ AS SALTING OUT AGENTS AND DIBUTYL "CARBITOL" AS EXTRACTION AGENT. Charles A. Kraus. Nov. 6, 1945. Decl. Jan. 17, 1956. 13p. Contract W-7405-eng-73. (BT-62). $3.30(ph OTS); $2.40(mf OTS).

**5193** A-2324
Brown Univ., Providence.
EXTRACTION OF $RO_2(NO_3)_2$ [$UO_2(NO_3)_2$] EMPLOYING METHYLISOBUTYL KETONE AS EXTRACTION AGENT. Charles A. Kraus. Nov. 30, 1945. 8p. Contract W-7405-eng-73. (BT-63). $1.80(ph OTS); $1.80(mf OTS).

**5194** A-2325
Brown Univ., Providence.
EXTRACTION OF $RO_2(NO_3)_2$ [$UO_2(NO_3)_2$] WITH DIBUTYL "CARBITOL" EMPLOYING BINARY MIXTURES OF NITRATES AS SALTING OUT AGENTS. Charles A. Kraus. Dec. 27, 1945. Decl. Jan. 17, 1956. 17p. Contract W-7405-eng-73. (BT-64). $3.30(ph OTS); $2.40(mf OTS).

**5195** A-2327
Brown Univ., Providence.
INFLUENCE AND CONTROL OF ACID IN EXTRACTION PROCESSES. Charles A. Kraus. Feb. 20, 1946. Decl. Jan. 17, 1956. 54p. Contract W-7405-eng-73. (BT-66). $9.30(ph OTS); $3.60(mf OTS).

Results are summarized from a series of investigations on the role of acid in processes designed to recover $UO_2(NO_3)_2$ from aqueous solution by extraction with a suitable organic solvent. Dibutyl carbitol, a triether having the formula $C_4H_9(OC_2H_4)_2OC_4H_9$, was employed as the extraction agent. Various metal nitrates, such as $Ca(NO_3)_2$, $Cu(NO_3)_2$, $Al(NO_3)_3$, and $Fe(NO_3)_3$ were employed as salting-out agents. (C.H.)

**5196** A-2706
Purdue Univ., Lafayette, Ind.
CHLORINATION OF TUBALLOY [U] OXIDES WITH THIONYL CHLORIDE. Summary Report. E. T. McBee, D. W. Pearce, and R. Mezey. Feb. 5, 1946. Decl. Jan. 17, 1956. 20p. Contract W-7405-eng-74. $4.80(ph OTS); $2.70(mf OTS).

Uranium oxides were successfully reacted with vapors of thionyl chloride at temperatures in the range of 350 to 400°C and at atmospheric pressure to produce U tetrachloride. Data are presented from preliminary investigations and from larger runs in which the characteristics of processes for producing U tetrachloride continuously or batchwise were compared. (C.H.)

**5197** A-3271
Carbide and Carbon Chemicals Corp. Substitute Alloy Materials Labs., New York.
$T_4F_{17}$, A NEW TUBALLOY FLUORIDE. A. Grenall, P. A. Agron, R. Kunin, and S. Weller. June 27, 1945. Decl. Dec. 8, 1955. 8p. (DA-R-16). $1.80(ph OTS); $1.80(mf OTS).

Data on the composition and x-ray-diffraction analysis of $U_4F_{17}$ are given. (B.J.H.)

**5198** A-4044
Ames Lab., Ames, Iowa.
RECOVERY OF URANIUM TURNINGS, CHIPS, AND BORINGS. C. F. Gray. Dec. 1945. Decl. Dec. 8, 1955. 117p. Contract [W-7405-eng-82]. (NNES-VII-2B(Chap.8). $18.30(ph OTS); $6.00(mf OTS).

Crude U biscuits were melted and cast into ingots, from which billets were cut. These billets were reheated to a temperature in the γ-range and then extruded into rods about 1.5 in. in diameter. These rods were straightened and cropped, and then machined into short segments 8 in. in length and 1.360 in. in diameter. A considerable amount of scrap accumulated during this operation. Procedures are described in detail for the recovery and handling of the finely divided U scrap such as turnings, chips, and borings. (C.H.)

**5199** AECD-3858
Tennessee Eastman Corp., Oak Ridge, Tenn.
APPLICATION OF CONDUCTIVITY MEASUREMENTS TO A STUDY OF (a) COMPLEX FORMATION BETWEEN $TO^{2++}$ [$UO_2^{2+}$] AND $F^-$ AND $Al^{+++}$ AND $F^-$ (b) TITRATION OF $F^-$ ION WITH $H^+$ ION. F. W. Tober. Sept. 25, 1945. Decl. Jan. 18, 1956. 17p. Contract W-7401-eng-23. (C-0.375.2). $3.30(ph OTS); $2.40(mf OTS).

Conductivity measurements show that addition of KF to a $UO_2^{2+}$ solution results in the formation of complexes containing $UO_2F$, $UO_2F_2$, and $UO_2F_5$. This complex formation does not take place in the presence of $Al^{3+}$ ion since the latter reacts the fluoride ions before the $UO_2^{2+}$ giving complexes of the type $AlF_3$, $AlF_5$, and $AlF_{10}$. Preliminary experiments indicate that there is a possibility that $F^-$ may be determined by titration with $H^+$ i.e., with acids. (auth)

**5200** AECD-3898
Tennessee Eastman Corp., Oak Ridge, Tenn.
A RAPID METHOD FOR DETERMINATION OF WATER IN $TO_3$ [$UO_3$]. B. B. Barash, F. B. Lee, and E. O. Curtiss. Feb. 16, 1945. Decl. Dec. 14, 1955. 13p. Contract W-7401-eng-23. (CD-Chem-S-567). $3.30(ph OTS); $2.40 (mf OTS).

A set of conditions is described for a ten minute determination of water in $TO_3$ [$UO_3$] by ignition and absorption of the evolved water in Mg perchlorate. Complete conversion to $T_3O_8$ [$U_3O_8$] is obtained under these conditions, so that total loss on ignition and total T [U] (plus non-volatile impurity) content may also be obtained. It has been found unnecessary to employ Cu foil to prevent interference by nitrates, which may be present with a nitrate/water ratio as high as 5, and in an amount that does not exceed 100 mg. (auth)

**5201** AECD-3899
Tennessee Eastman Corp., Oak Ridge, Tenn.
RECOVERY OF TUBALLOY FROM SOLUTIONS CONTAINING FLUORIDE ION. Fred Smith, Frank Tober, E. J. Lord, L. J. Andrews and J. W. Gates, Jr. Feb. 27, 1945. Decl. Dec. 15, 1955. 9p. Contract W-7401-eng-23. (CD-4006; XAC-R-373). $3.30(ph OTS); $2.40(mf OTS).

An ether extraction method is described for the quantitative recovery of U from solutions containing high concentrations of fluoride ion. The method consists of the addition of aluminum nitrate to the solution in order to complex the fluoride ion, followed by saturation with calcium nitrate and extraction of the U with dibutyl carbitol. Results of this method are described in some detail. (B.J.H.)

**5202** AECD-3918
Tennessee Eastman Corp., Oak Ridge, Tenn.
A PILOT PLANT FOR THE PREPARATION OF URANIUM TETRACHLORIDE BY FLUIDIZATION. H. A. Perlmutter,

J. H. Coobs, R. S. Lowrie, and A. J. Miller. Mar. 12, 1946. Decl. Dec. 21, 1955. 16p. Contract W-7401-eng-23. (C-2.350.9). $3.30(ph OTS); $2.40(mf OTS).

A pilot plant for the preparation of $UCl_4$ by fluidization from $UO_3$ was designed, constructed, and tested. Uranium (VI) oxide was converted in 50-min reaction periods to $UCl_4$ in 98.8% yields. Carbon tetrachloride was the chlorinating agent. (auth)

**5203** AECD-3961
Tennessee Eastman Corp., Oak Ridge, Tenn.
TUBALLOY OXIDES IN THE REDUCTION OF $TO_3$. Charles Tanford, R. L. Tichenor, and C. E. Larson. July 16, 1945. Decl. Dec. 20, 1955. 20p. Contract W-7401-eng-23. (C-3.385.1). $3.30(ph OTS); $2.40(mf OTS).

The reduction of $UO_3$ by H has been shown to proceed in three separate stages. The first of these is a rapid decomposition of $UO_3$ with evolution of $O_2$ gas, independent of the hydrogen pressure. The rate of the second and third stages of the reaction increases as the hydrogen pressure rises in the same manner as the amount of gases adsorbed on most oxide surfaces increases with pressure. As the temperature rises, the rate of these reactions increases, passing through a maximum near 800°C, and then falls slightly. The rate of the third stage of the reaction has been shown to be nearly independent of the extent of reaction. From these observations we conclude that the last two reactions involve adsorption of hydrogen on the oxide surface followed by formation of water molecules on the surface. As a consequence of this mechanism, it should be possible to increase or decrease the velocity of $UO_3$ reduction by appropriate changes in the oxide surface. It has been shown that this can indeed be done: a specially-prepared, finely-divided oxide reduces with greatly increased velocity, while an oxide contaminated with Al oxide apparently has a poisoned surface and reduces comparatively slowly. A survey of the literature on the oxides of U of composition between $UO_2$ and $UO_3$ shows that $UO_2-UO_{2.25}$ and $UO_{2.6}-UO_3$ are compounds of variable composition analogous to W bronzes or Ni oxides. The work of Biltz and Müller on the thermal degradation of these oxides has been quoted in some detail and confirmed experimentally. (auth)

**5204** AECD-3970
[Tennessee Eastman Corp., Oak Ridge, Tenn.]
THE PRESERVATION OF FLUORESCENCE STANDARDS. Henry M. Grotta. Feb. 15, 1946. 6p. Decl. Dec. 15, 1955. (CD-185-285). $1.80(ph OTS); $1.80(mf OTS).

The useful life of uranium standards for use in the fluorescence method of U analysis was improved by allowing the standards to remain permanently in the Pt dish in which they were fused and coating them with methyl methacrylate. (C.H.)

**5205** ANL-5084
Argonne National Lab., Lemont, Ill.
DISSOLUTION OF URANIUM OXIDE ARISING FROM SLUG FAILURE. F. J. Johnston, P. E. Wills, and J. J. Katz. July, 1953. Decl. Dec. 13, 1955. 13p. Contract W-31-109-eng-38. $3.30(ph OTS); $2.40(mf OTS)

A study of reagents which might be effective in dissolving $UO_2$ produced during slug failure in $H_2O$-cooled reactor systems is presented. Initial experiments in the search for suitable reagents were performed using $H_5IO_6$ as a standard. Prospective reagents were tested, and their effectiveness in dissolving the $UO_2$ was compared visually with that of periodic acid in comparable concentrations. Promising reagents were then tested quantitatively, solutions being analyzed for U. Both $UO_2$ prepared at high-temperature and $UO_2$ produced under conditions simulating actual slug failure were used in the initial experiments. The rate of solution of the high-temperature-produced oxide was very much slower than that of the autoclave oxide. The latter was used exclusively in the later experiments. Discussion and tabulated results are given for reagents-testing experiments which fall into 3 categories; $O_3$ and $H_2O_2$ each used in combination with other oxidants, acids or complexing agents, and miscellaneous reagents. A series of semiquantitative experiments were undertaken to determine solubilities of $UO_2$ and $H_2O$ in which autoclave-prepared $UO_2$ was exposed to $H_2O$ under varying conditions of oxygenation, $H_2O$ pretreatment, and temperature of exposure. (D.E.B.)

**5206** BC-18
[California. Univ., Berkeley. Radiation Lab.]
THE $UOBr_2$ DISPROPORTIONATION EQUILIBRIUM. N. W. Gregory. Aug. 23, 1946. Decl. Jan. 18, 1956. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

$UOBr_2$ was prepared by reaction of $UBr_4$ gas on $UO_2$ solid in the neighborhood of 500°C. The equilibrium $2\ UOBr_{2(s)} = UO_{2(s)} + UBr_{4(g)}$ is shifted to the left under conditions used in the preparation which employ $UBr_4$ pressures equal to the vapor pressure of the solid at reaction temperatures. In high vacuum, however, disproportionation of the oxybromide occurs at appreciable rates at temperatures above 475°C. The equilibrium pressure of $UBr_4$ above the solid was determined at various temperatures using the effusion method, following a procedure similar to that employed in the study of the analogous chloride system. (auth)

**5207** CC-355
Chicago. Univ. Metallurgical Lab.
EFFECT OF TEMPERATURE ON THE SURFACE OF CAST URANIUM METAL. I. B. Johns, A. S. Newton, and E. M. Gladrow. Dec. 3, 1942. Decl. Dec. 14, 1955. 6p. (A-389). $1.80(ph OTS); $1.80(mf OTS).

**5208** CC-1201
Ames Lab., Ames, Iowa.
URANIUM HYDRIDE. A Review to January 1, 1944. A. S. Newton, comp. Feb. 10, 1944. Decl. Dec. 13, 1955. 30p. (A-1681). $4.80(ph OTS); $2.70(mf OTS).

**5209** CC-2105
[California. Univ., Berkeley. Radiation Lab.]
ELECTROLYTIC PRODUCTION OF URANIUM FROM SOLUTIONS OF ITS TRIBROMIDE IN FUSED SALTS. Richard A. Webster. Aug. 15, 1944. Decl. Dec. 1, 1955. 8p. Contract [W-7405-eng-48]. (MB-183). $1.80 (ph OTS); $1.80(mf OTS).

The electrodeposition of U metal, in the form of tree-like deposits, from molten Sr halide baths is described. Under the best conditions studied, approximately 40% recovery is attained. Freedom from side reactions of the reduced U with anode products and/or refractory materials, and high cathode current densities appear to be essential to the success of the process. The refining of U under similar conditions appears to occur quite readily, with approximately 50% current efficiency. The preparation of $UI_3$ is also described. (auth)

**5210** CC-3618
California. Univ., Berkeley. [Radiation Lab.]
I. THE CHARGE ON URANIUM(VI) IN ACID SOLUTION. II. THE ACTIVITY OF URANIUM(VI)–TTA CHELATE IN BENZENE SOLUTIONS OF TTA. Edward L. King. Aug. 15, 1946. Decl. Jan. 5, 1956. 20p. Contract W-7405-eng-48b. $3.30(ph OTS); $2.40(mf OTS).

The distribution coefficient of uranium(VI) between perchloric acid solutions and benzene solutions of TTA has been measured as a function of the acidity. It was possible to interpret these data in terms of the charge on the uranium(VI) species present in the aqueous phase. The experiments indicate that uranium(VI) exists as an ion of

charge +2 at acidities from 0.1 M to 2.5 M. In the interpretations of the distribution data it was necessary to know the activity coefficient of the uranyl chelate in the benzene solution. This was determined by measurement of the solubility of the compound $UO_2K_2 \cdot xH_2O$. The activity coefficient of $UO_2K_2$ was found to decrease rapidly as the concentration of TTA in the benzene phase increased above 0.1 M. This is probably due to the formation of a species involving more than two TTA molecules per uranium(VI). (auth)

**5211** HW-18260

Hanford Works, Richland, Wash.

INFRARED MEASUREMENTS ON THE SYSTEM HEXONE–WATER–URANYL NITRATE. L. L. Burger and R. H. Moore. June 15, 1950. Decl. Dec. 8, 1955. 17p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

The absorption bands in the spectra of $UO_2(NO_3)_2$ in hexone, $UO_2Cl_2$ in hexone, $UO_2(NO_3)_2$ in ether, $UO_2(NO_3)_2$ dihydrate (solid), hexone, ether, 8-hydroxyquinoline, and the uranyl derivatives of 8-hydroxyquinoline have been measured. An absorption band is found at 1662 to 1667 $cm^{-1}$ in the spectra of solutions of $UO_2(NO_3)_2$ and $UO_2Cl_2$ in hexone which is not assignable to any of these individual substances. The presence of this band is cited as evidence for complex formation between hexone and uranyl compounds. No absorption band assignable to a U–O group was found and no displacement of bands (other than the C:O band) in the hexone spectrum or in the spectrum of $UO_2(NO_3)_2$ was observed. These observations suggest that the complex formed between hexone and uranyl compounds does not approach the strength of covalent-bonded compounds. The data are in agreement, however, with the conception of a strong attraction between the uranium atom and the basic carbonyl oxygen. This interaction has shifted the carbonyl band from its normal position at 1716 $cm^{-1}$ to one of lower frequency, at 1662 $cm^{-1}$ to 1667 $cm^{-1}$. The formation of definite hydrates of $UO_2(NO_3)_2$ dissolved in hexone has been demonstrated. Dissolution of $UO_2(NO_3)_2$ in ether results in a shift of the C–O–C band at 1130 $cm^{-1}$ to 1098 $cm^{-1}$. (auth)

**5212** K-89

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

THE DETERMINATION OF URANIUM ALPHA ACTIVITY IN HUMAN URINE. F. W. Hurd and J. S. Fox. Dec. 5, 1947. Decl. Dec. 12, 1955. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A method for the determination of U in human urine by means of the $\alpha$ activity of the U is described. Using this method it is possible to detect the $\alpha$ radiation from 0.01 mg of normal U per 100 ml of urine or a concentration of 100 parts per billion. The following method is used: a 100-ml sample of urine is boiled with HCl, aluminum nitrate is added and the pH of the solution raised to 6.5 with $NH_4OH$. After centrifuging, the precipitate is dissolved and reprecipitated. This precipitate is redissolved in HCl. The HCl solution is evaporated slowly on Ag disks and the disks are $\alpha$ counted in a low background $\alpha$ counter. Results are reported as $\alpha$ counts per minute per 100 ml of urine. (auth)

**5213** K-425

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

HIGH TEMPERATURE HYDROGENATION-HYDROFLUORINATION OF URANYL AMMONIUM PHOSPHATE TO URANIUM TETRAFLUORIDE. H. A. Bernhardt, W. Davis, Jr., J. R. Flanary, and R. J. Heus. July 15, 1949. Decl. Jan. 6, 1956. 26p. Contract W-7405-eng-26. (KLO-114). $4.80(ph OTS); $2.70(mf OTS).

Recovery of U from waste solutions by precipitation as uranyl ammonium phosphate and conversion of the latter to $UF_4$ has necessitated further study of the conversion reaction. Uranium tetrafluoride was formed by the reaction of uranyl ammonium phosphate with a mixture of H and HF in the temperature range 500 to 700°C. At 500°C the conversion to $UF_4$ is slow and incomplete; at 700°C conversion is nearly complete within one hour for samples of 4 to 5 gm. Within the fairly large experimental errors, the reduction reaction follows a first order rate law with an apparent activation energy of about 18 kcal/mole. (auth)

**5214** KLX-1614

Vitro Corp. of America, New York.

HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] APRIL 1953. Job 57. May 10, 1953. Decl. Jan. 12, 1956. 11p. Contract AT(11-1)-217. $3.30 (ph OTS); $2.40(mf OTS).

A study was continued on the feasibility and economics of inorganic and resin ion exchange separation of reactor processing by products from $UO_2SO_4$ fuel solutions. Studies were made with various adsorbents at 250°C and 1,000 psig, and calculations were made of the percentage of $\beta$-radioactive material and U removed by the adsorbents. The results of these calculations are tabulated. (B.J.H.)

**5215** KLX-1615

Vitro Corp. of America, New York.

HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] MAY, 1953. Job 57. June 10, 1953. Decl. Jan. 12, 1956. 12p. Contract AT(11-1)-217. $3.30(ph OTS); $2.40(mf OTS).

Garnet sand, $CaWO_4$, and $ThF_4$ were tested for efficacy in removing Ce from $UO_2SO_4$ solutions. All were effective, but $CaWO_4$ removed the U as well. In a study of temperature effects on Ce adsorption and adsorbent solubility, fluorspar at 100 to 250°C removed Ce efficiently. High-purity fluorspar, 40- to 60-mesh, adsorbed over 90% of the Ce at 100°C. (For preceding period see KLX-1614.) (B.J.H.)

**5216** M-887

Brown Univ., Providence.

[STUDY OF FACTORS WHICH INFLUENCE THE RATE OF REACTION BETWEEN $UO_3$ AND $CCl_4$.] Progress Report. Charles A. Kraus. Dec. 15, 1942. Decl. Jan. 10, 1956. 9p. Contracts OEMsr-290, Suppl. 2, and OEMsr-688. (BT-15). $1.80(ph OTS); $1.80(mf OTS).

**5217** M-3001

[Du Pont de Nemours (E. I.) and Co.] Jackson Lab. [Wilmington, Del.]

TENTATIVE DYE WORKS PROCESS FOR THE MANUFACTURE OF [$UO_4 \cdot 2H_2O$] C-112 PASTE FROM C-100. [$Na_2UO_4$] Louis Spiegler. Mar. 9, 1943. Decl. Jan. 10, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

Sodium uranate is dissolved in dilute $H_2SO_4$ at 70 to 75°C. Excess of $H_2SO_4$ and Fe present as impurity are precipitated by neutralization with $CaCO_3$. Calcium sulfate and basic iron sulfate are filtered off. The clarified filtrate is treated with $H_2O_2$ 25 to 30°C. which precipitates $UO_4 \cdot 2H_2O$ as a cream yellow product. This is isolated by centrifuging. The product is purified from water soluble impurities by repeated repulping with distilled water followed by centrifuging to remove liquors. (auth)

**5218** M-3009

Du Pont de Nemours (E. I.) & Co. Jackson Lab., Wilmington, Del.

REPORT OF INSPECTION TRIP TO IOWA STATE COLLEGE, AMES, IOWA. E. W. FIELDING AND T. W. STRICKLIN, JR., NOVEMBER 11, 1942, ON THE MANUFACTURING PROCESS FOR THE PRODUCTION OF TUBEALLOY FROM TETRA. Report No. 2. T. W.

Stricklin, Jr. Decl. Jan. 10, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

The principles of the process and brief descriptions of the equipment and process whereby U is produced by Ca reduction of $UF_4$ are presented. (L.M.T.)

**5219** M-4248

Princeton Univ., N. J. Frick Chemical Lab.

THE INTERFERENCE OF NICKEL IN THE REDUCTION OF URANIUM SOLUTIONS IN THE JONES REDUCTOR. A STUDY OF THE EFFECTS OF NICKEL, COBALT, MANGANESE, ZINC, CALCIUM, MAGNESIUM, ALUMINUM AND SODIUM IONS UPON THE REDUCTION. N. H. Furman and J. B. Heberling. Revised May 1947. Decl. Dec. 5, 1955. 8p. Contract W-7405-Eng-81. $1.80(ph OTS); $1.80(mf OTS).

Nickel interferes seriously with the reduction of uranyl solutions in the Jones reductor. The Ni that is deposited causes vigorous $H_2$ evolution so that eventually the reductor will not reduce uranyl solutions quantitatively. Cobalt, Mn, Zn, Ca, Mg, Al, and Na ions have no apparent action upon the reduction or the subsequent aeration to convert U(III) to U(IV). Nickel ion, if added after reduction of a U solution has no harmful effect upon the aeration and titration with standard ceric sulfate solution. (auth)

**5220** M-4251

Princeton Univ., N. J. Frick Chemical Lab.

THE VOLUMETRIC ASSAY OF URANIUM TETRAFLUORIDE. N. H. Furman and G. P. Haight, Jr. Apr. 1946. Revised May 1947. Decl. Dec. 5, 1955. 12p. Contract W-7405-Eng-81. $3.30(ph OTS); $2.40(mf OTS).

In the method described, $UF_4$ is dissolved in a boric acid–sulfuric acid mixture. The soluble U(IV) is then titrated with ceric sulfate after which an excess of that reagent is added, and after warming to dissolve the dioxide, etc., the excess of ceric sulfate is determined. The data are then used to calculate the percentages of $UF_4$, "dioxide," and uranyl fluoride (by differenc). (auth)

**5221** M-4253

Princeton Univ., N. J. Frick Chemical Lab.

A MODIFIED METHOD FOR THE DETERMINATION OF CHROMIUM IN URANIUM OR ITS COMPOUNDS. C. E. Bricker and N. H. Furman. June 19, 1943. Decl. Dec. 5, 1955. 11p. $3.30(ph OTS); $2.40(mf OTS).

In the detailed method outlined, permanganate in a $H_2SO_4$ solution is used to oxidize Cr to chromate. The excess of the permanganate is destroyed by adding Na azide. (L.M.T.)

**5222** MCW-31

Mallinckrodt Chemical Works, St. Louis.

SOME SOLUBILITY AND WASHING DATA FOR FERRIC NITRATE IN ETHER SOLUTIONS OF URANYL NITRATE. A. E. Ruehle. Apr. 1, 1946. Decl. Jan. 11, 1956. 6p. Contract W-14-108-eng-8. NNES-VII-2B(Chap.10). $1.80 (ph OTS); $1.80(mf OTS).

Solubility and washing data of $Fe(NO_3)_3$ in an ethereal solution of $UO_2(NO_3)_2$ have been taken. It was found that complete separation between the ether and aqueous phases of $UO_2(NO_3)_2$ solutions is attained only after long standing. Dispersed droplets of aqueous Fe solution are washed out of ether at a faster rate than is Fe in true solution, hence, after a relatively small number of washes the final value is attained regardless of previous settling. (auth)

**5223** MCW-185

Mallinckrodt Chemical Works, St. Louis.

AQUEOUS OXIDATION OF METALLIC URANIUM "SAWDUST." O. Buckheim. May 12, 1949. Decl. Jan. 12, 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

Finely divided uranium may be completely oxidized to $UO_2$ by boiling in $H_2O$ with and without aeration. Aeration of the $UO_2$ slurry yielded $UO_3$. Proposed equations for the water-oxidation of U are: $U \xrightarrow[H_2O]{} U(OH)_4 \xrightarrow[H_2O]{} H_2UO_4 \xrightarrow[0]{cat} UO_3$. (C.W.H.)

**5224** MonC-77

[Clinton Labs., Oak Ridge, Tenn.]

PURIFICATION OF HOMOGENEOUS CHAIN REACTING SOLUTIONS: PROTIUM – DEUTERIUM EXCHANGE WITH AMBERLITE IR-1. Period [covered] April 15 to June 1, 1945. Problem Assignment No. CX5-1. A. W. Adamson and G. E. Boyd. Apr. 2, 1946. Decl. Jan. 11, 1956. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

The exchange of deuterium from $D_2O$ with the hydrogen of the resinous organic ion exchanger, Amberlite IR-1 (as $UO_2R$) was shown to be rapid and complete within 30 minutes. The exchange was found to be limited to the normal water content of the air-dried adsorbent. (auth)

**5225** N-34

Du Pont de Nemours (E. I.) & Co. Jackson Lab., Wilmington, Del.

TUBEALLOY PROCESS RESEARCH MEMORANDUM. I. W. Dobratz, R. C. Downing, C. L. Richardson, and L. Spiegler. April 9, 1943. Decl. Jan. 11, 1956. 12p. $3.30 (ph OTS); $2.40(mf OTS).

The $H_2O$ solubility of $UF_4$ over a range of temperatures was determined. Oxidation occurred at elevated temperatures. Peruranic acid from slag recovery processes was evaluated for quality and yield. $UF_4$ production and HF recovery for the period are given. (D.E.B.)

**5226** NYO-5052

Mallinckrodt Chemical Works, St. Louis.

42-43A METAL [URANIUM]–EFFECT OF ADDING MAGNESIUM AND CALCIUM FLUORIDES TO THE LIME LINER. Report No. 4. June 2, 1944. Decl. Jan. 12, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

In the bomb reduction of $UF_4$ with Mg, the breakdown of the lime shell liner causes contamination of the metal product along with a rough, slag-covered surface. Ground slag and powdered fluorspar were mixed with lime and tested as bomb-liner materials. It was concluded that the addition of 5 to 20% of either slag of fluorspar to lime may improve the strength of the liner; however, the quantity of hard slag adhering to the metal biscuit was increased. The metal yield was not appreciably affected. (G.Y.)

**5227** NYO-5074

Mallinckrodt Chemical Works, St. Louis.

EFFECT OF THE NITROGEN CONTENT OF MAGNESIUM USED IN REDUCTION ON CASTING YIELD. William A. Oppold. Jan. 13, 1945. Decl. Jan. 13, 1956. 3p. Contract W-7405-eng-29. $1.80(ph OTS); $1.80(mf OTS).

Magnesium having a high nitrogen content (300 to 1100 ppm), gave a reduced U recasting yield. Up to 300 ppm, the uranium yield can be kept above 96%, but in the range above this, the yield drops off at a steeper rate, and at 1000 ppm, the yield is in the low 95% range. (C.W.H.)

**5228** NYO-5084

Mallinckrodt Chemical Works, St. Louis.

METHOD OF WASHING [URANIUM METAL] SAWDUST. William A. Oppold. Feb. 26, 1945. Decl. Jan. 10, 1956. 5p. Contract W-7405-eng-29. $1.80(ph OTS); $1.80 (mf OTS).

Design and construction of a mechanical washer capable of washing 200 lbs of sawdust (U metal) at a time are described. A procedure for washing the sawdust is also given. (C.W.H.)

**5229** NYO-5259

[Mallinckrodt Chemical Works, St. Louis]

TENTATIVE OPERATING PROCEDURE—SAWDUST [U

METAL] CONVERTER. [nd]. Decl. Jan. 13, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

Operating procedures for the wet burner, which is designed to convert metal sawdust to $UO_2$, are presented. The safe handling of metal sawdust is discussed. (C.W.H.)

**5230** NYO-5260
[Mallinckrodt Chemical Works, St. Louis]
CONVERSION OF METAL TO HEX [URANYL NITRATE HEXAHYDRATE] FOR SHOTGUN TEST. T. Braddock and J. R. Lacher. [nd]. Decl. Jan. 13, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

Uranium can be converted into $UO_2(NO_3)_2 \cdot 6H_2O$ by dissolving the metal directly in $HNO_3$ or by oxidizing the metal to $U_3O_8$ and dissolving the resulting product. The rate of oxidation of U chunks in humid air and the rate of solution in $HNO_3$ are discussed. (J.E.D.)

**5231** RL-4.6.216
[California. Univ., Berkeley. Radiation Lab.]
QUALITATIVE DETERMINATION OF IRON IN THE PRESENCE OF TUBALLOY USING FILTER PAPER SATURATED IN 8-HYDROXYQUINOLINE. Mary Mingay. Oct. 5, 1943. Decl. Jan. 5, 1956. 6p. Contract W-7405-eng-48. (CHEM S 216). $1.80(ph OTS); $1.80(mf OTS).

A qualitative method is described for the determination of Fe in the presence of U. The method uses filter paper saturated in 8-hydroxyquinoline. When a drop of test solution is added to the filter paper the Fe is adsorbed first to give a black ring and the uranyl ion next, giving an orange ring outside the black one. (C.H.)

## WASTE DISPOSAL

**5232** KLX-1326
Kellex Corp., New York.
DECONTAMINATION OF CRIB WASTES (24-A3). Summary Progress Report [for] November 1950. Job 24-A. Dec. 21, 1950. Decl. Jan. 10, 1956. 5p. Contract AT(30-1)-850. $1.80(ph OTS); $1.80(mf OTS).

Data were obtained on the factors affecting the adsorptive capacity of an equal volume mixture of resins IR-120 and IRA-400, pretreated with HCl, for Purex waste freed from $HNO_3$. (L.M.T.)

**5233** KLX-1336
Kellex Corp., New York.
DECONTAMINATION OF CRIB WASTES (24-A3). Summary Progress Report [for] February 1951. Job 24-A. Mar. 7, 1951. Decl. Jan. 9, 1956. 7p. Contract AT(30-1)-850. $1.80(ph OTS); $1.80(mf OTS).

A series of column runs were conducted to study the effect on column efficiency of varying the flow rate, using a feed of high activity. Also, a new series of runs was started to determine the decontamination efficiencies of columns packed with resins of various ionic forms. Besides the two new series of runs started in February, runs on the decontamination of activated Jersey City tap water, the sustained performance of a mixed resin bed, and the physical performance of resin beds were continued. (auth)

**5234** KLX-1339
Kellex Corp., New York.
DECONTAMINATION OF CRIB WASTES (24-A3). Progress Report [for] First Quarter, 1951. Job 24-A. Apr. 16, 1951. Decl. Jan. 10, 1956. 15p. Contract AT(30-1)-850. $3.30(ph OTS); $2.40(mf OTS).

**5235** KLX-1363
Vitro Corp. of America, New York.
DECONTAMINATION OF DILUTE LOW ACTIVITY WASTES BY ION EXCHANGE. Progress Report [for] Third Quarter, 1951. Job 24-A. Dec. 14, 1951. Decl. Jan. 9, 1956. 17p. Contract AT(30-1)-850. $3.30 (ph OTS); $2.40(mf OTS).

Poor resin capacities found in pilot-plant test runs have been attributed to the presence of colloidal matter in the demineralized feed water resulting from storage in contact with metal surfaces. The best results, using demineralized water, were obtained when the water was passed through a charcoal bed prior to feed preparation. Rubber-lined feed preparation tanks gave better results than could be obtained in stainless steel. In no case did the results obtained with demineralized water approach those obtained with distilled water. Regeneration of the pilot-plant resin bed with 5% HCl required twice the volume as the 10% HCl. A satisfactory method of eluate disposal by solidification with Portland cement is given. The hydroxyl form of the anionic resin was compared with the chloride form as to decontamination of a simulated $Ru^{106}$ and Purex waste. Additional tests with versene as a complexing agent for metal ions indicate that pH range of 8 to 9 is optimum for the addition of this material to contaminated cooling water or to wastes which have picked up colloidal material from metal surfaces. (L.M.T.)

**5236** MLM-380
Mound Lab., Miamisburg, Ohio.
QUARTERLY REPORT FOR LIQUID WASTE DISPOSAL RESEARCH [FOR] JULY 1, 1949 TO SEPTEMBER 30, 1949. Oct. 1, 1949. Decl. Jan. 13, 1956. 24p. Contract AT-33-1-Gen-53. $3.30(ph OTS); $2.40(mf OTS).

Processes for the decontamination of Hanford second cycle (crib) wastes proceeded along two lines: precipitation and adsorption. Precipitation experiments included the formation of ferro ferrocyanide which is specific for Ru, precipitation of Cs carrier with silicotungstic acid and luteo phosphomolybdic acid, and the formation of metallic Ru by reduction with Fe. Adsorption studies were made on activated carbons for Ru, and clays for Cs. (L.M.T.)

**5237** ORNL-163
Oak Ridge National Lab., Tenn.
MINUTES OF CONFERENCE ON LIQUID WASTE DISPOSAL, AUGUST 23-25, 1948. Nov. 2, 1948. Decl. Jan. 13, 1956. 43p. $7.80(ph OTS); $3.30(mf OTS).

Reports on the existing waste disposal program at Oak Ridge and its effectiveness are given. Ion exchange, scavenger, and evaporation techniques employed in waste treatment are reviewed. Studies of rare earth separation from waste are reported. (D.E.B.)

**5238** ORNL-722
Oak Ridge National Lab., Tenn.
CONTROL OF FOAMING DURING EVAPORATION OF RADIOCHEMICAL WASTES. T. C. Runion. June 27, 1950. Decl. Jan. 6, 1956. 21p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Results of studies on ORNL evaporator feeds indicate that dissolved organic matter is the primary cause of foaming, and not the actual salt concentration. This foam is probably stabilized by the presence of suspended solids (calcium, alumina, etc.), since clarified solutions showed decreased foaming properties and antifoam agents were generally more effective. The foam volumes were reduced by factors of four to five by the use of such commercially available anti-foam agents as "Nonisol-300," "Alrowax" and Span-20, in concentrations of about 100 ppm. The first two are vended by the Alrose Chemical Company and the last by the Atlas Powder Company. Oleyl 0-8, sold by M. Michel and Co., and DC-200 (Dow Corning Corp.) were also good anti-foam agents for this system but somewhat inferior to the others. A final choice probably should be made solely on the basis of cost. (auth)

Refer also to abstract 5150.

# ENGINEERING

**5239** ISC-320
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN ENGINEERING FOR OCTOBER, NOVEMBER AND DECEMBER 1952. Mar. 3, 1953. Decl. Jan. 11, 1956. 16p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

The status of the work is briefly reported on production of Th from monazite, production of $ThF_4$ with aqueous Hf, Zr process development (zircon sand and molten caustic), spectral and total emissivity studies of refractory materials, and slurry head loss in straight tubes vs. Reynolds number. (J.E.D.)

**5240** KLX-63
Kellex Corp., New York.
JAW TYPE REMOTE CONNECTORS. Detailed Project Status Report. Job 11. Aug. 26, 1949. Decl. Jan. 9, 1956. 11p. Contract AT-30-1-Gen-169. $3.30(ph OTS); $2.40(mf OTS).

The 4-in. connector designed for this project is similar to the smaller connectors of the same type and essentially all of the design features of the smaller connectors were incorporated in the 4-in. model. Initial testing of the model produced generally satisfactory results, but additional testing and modification would be required to check out the design before a prototype could be fabricated. (auth)

**5241** KLX-64
Kellex Corp., New York.
WELDING INVESTIGATION OF STAINLESS STEEL PIPE; DETAILED PROJECT STATUS REPORT. JOB 11. Aug. 29, 1949. Decl. Jan. 10, 1956. 41p. $6.30(ph OTS); $3.00 (mf OTS).

**5242** KLX-68
Kellex Corp., New York.
REMOTELY OPERATED THOMPSON DISCONNECT. Detailed Project Status Report. Job 11. Sept. 26, 1949. Decl. Jan. 9, 1956. 21p. Contract AT-30-1-Gen-169. $3.30(ph OTS); $2.40(mf OTS).

**5243** KLX-1312
Kellex Corp., New York.
MAGNETIC INDUCTION FLOWMETER DEVELOPMENT. First Quarterly Progress Report, May 1–July 31, 1950. Job 24-B4. Aug. 15, 1950. Decl. Jan. 9, 1956. 33p. Contract AT(30-1)-850. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on a 1000 cc/min flowmeter utilizing a glass flow tube with Pt electrodes and operating in a 60-cps magnetic field. This tube, in conjunction with a stable low noise amplifier and a commercial recorder, is capable of measuring the volume flow of a wide variety of acid radioactive solutions with a maximum error of ± 1% of full-scale. (L.M.T.)

**5244** KLX-1321
Kellex Corp., New York.
MAGNETIC INDUCTION FLOWMETER DEVELOPMENT. Second Quarterly Progress Report [for] August 1–October 31, 1950. Dec. 21, 1950. Decl. Jan. 9, 1956. 25p. Contract AT(30-1)850. $6.30(ph OTS); $3.00(mf OTS).

**5245** KLX-1334
Kellex Corp., New York.
MAGNETIC INDUCTION FLOWMETER DEVELOPMENT. Quarterly Progress Report No. 3 [for] November 1, 1950–January 31, 1951. Job 24-B4. Feb. 26, 1951. Decl. Jan. 9, 1956. 17p. Contract AT(30-1)-850. $4.80(ph OTS); $2.70(mf OTS).

**5246** KLX-1347
Kellex Corp., New York.
MAGNETIC INDUCTION FLOWMETER DEVELOPMENT. Quarterly Progress Report No. 4 [for] February 1–April 30, 1951. Job 24-B4. June 6, 1951. Decl. Jan. 11, 1956. 18p. Contract AT(30-1)-850. $4.80(ph OTS); $2.70(mf OTS).

A 1000 cc/min flowmeter is described, with photographs and an electrical circuit schematic given. (L.M.T.)

**5247** KLX-1390
Vitro Corp. of America, New York.
MAGNETIC INDUCTION FLOWMETER DEVELOPMENT. Project Status Report [for] July 1, 1951–June 30, 1952. Job 24-B4. June 30, 1953. Decl. Jan. 10, 1956. 62p. Contract AT(30-1)-850. $10.80(ph OTS); $3.90(mf OTS).

## AEROSOLS

**5248** KLX-55
Kellex Corp., New York.
DECONTAMINATION OF WASTE GASES. Detailed Project Status Report. Job 11. Sept. 23, 1949. Decl. Jan. 11, 1956. 60p. Contract AT-30-1-gen-169. $10.80(ph OTS); $3.90(mf OTS).

The results of a laboratory investigation of possible procedures for removing radioactive particulate material entrained in gas streams has indicated that, by use of a steam injection technique, removal efficiencies approaching those currently being obtained by CWS-6 filter paper and sand filters can be realized in a commercial wet impingement plate scrubber operating on a nonradioactive dust suspension which approximates actual plant conditions. Operating the scrubber alone proved unsatisfactory. A preliminary investigation of the effect of sonic agglomeration on a nonradioactive dust suspension has revealed appreciable, though not completely satisfactory, improvement in the separation efficiency of the wet scrubber. Methods were developed for generating and analyzing both radioactive and nonradioactive air-borne particulate matter and were successfully applied to the evaluation of various types of filter papers and to a pilot-plant gas-cleaning system. The investigation demonstrated the feasibility of operating a pilot plant system for the evaluation of air cleaning equipment using laboratory-generated test suspensions. (auth)

**5249** KLX-1380
Vitro Corp. of America, New York.
GAS DECONTAMINATION. Project Summary [for] February 1950–December 1951. Job 24-A2. Decl. Jan. 11, 1956. 66p. Contract AT(30-1)-850. $15.30(ph OTS); $5.40(mf OTS).

The effectiveness of certain particle conditioning techniques applied to gas streams containing radioactive particulate matter for the purpose of improving the clean-up efficiencies of commercially available separators such as cyclones and scrubbers used in wet removal systems was evaluated. (C.W.H.)

## HEAT TRANSFER AND FLUID FLOW

**5250** CP-2332
[Chicago. Univ. Metallurgical Lab.]
THE THERMAL CONDUCTIVITY OF SOME PROJECT MATERIALS. Charles H. Raeth. Dec. 7, 1944. Decl. Jan. 4, 1956. 25p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

A method for measuring the thermal conductivity of moderately good conductors is described. Data on Be, 97% Be–3% Al, Th, graphite, brass, and piles of oxidized Al disks are presented. (G.Y.)

**5251** M-1485
Columbia Univ., New York. Div. of War Research.
MEMORANDUM ON FLOW OF GAS THROUGH CAPIL-

LARY TUBES. Edward Melkonian. Jan. 11, 1945. Decl. Jan. 7, 1956. 5p. Contract W-7405-eng-50. (1D-M289). $1.80(ph OTS); $1.80(mf OTS).

It is shown that for both diffusive and viscous flow, the quantity $\frac{1}{r^3}\sqrt{\frac{RT}{M}}\frac{Q_m}{\Delta p}$ is independent of all variables except the ratio $r/\bar{\lambda}$, where l and r are the length and radius of the capillary, M the molecular weight of the gas used, $Q_m$ the mass flow rate, $\Delta p$ the pressure difference across the capillary, and $\bar{\lambda}$ is the mean free path in the gas at average pressure. (K.S.)

**5252** N-1908

[Chicago. Univ. Metallurgical Lab.]

SOME NOTES ON FALLING FILMS. G. Young. Mar. 1, 1945. Decl. Jan. 12, 1956. 5p. Contract [W-7401-Eng-37]. (MUC-GY-29). $1.80(ph OTS); $1.80(mf OTS).

Calculations are made of the flow of a layer of liquid along a vertical wall. Both streamline and turbulent flow are considered. (B.J.H.)

### MATERIALS TESTING

**5253** CF-50-6-9

Oak Ridge National Lab., Tenn.

THERMAL STRESS IN BERYLLIUM CLASS II PIECES. J. A. Lane. June 2, 1950. Decl. Jan. 18, 1956. 5p. $1.80 (ph OTS); $1.80(mf OTS).

**5254** CP-2108

[Chicago. Univ. Metallurgical Lab.]

ENGINEERING GROUP INSTRUMENT SPECIFICATION REPORT: TESTS ON AQUADAG TREATED POLYETHYLENE CABLE. (Report No. BK50213; N-1282b). Barton L. Weller. Feb. 23, 1944. 2p. TESTS ON AQUADAG TREATED POLYETHYLENE CABLE. Supplement to Report No. BK50213. (Report No. BK50222). John Dorsey. Mar. 27, 1944. 2p. TESTS ON AQUADAG TREATED POLYETHYLENE CABLE. Supplement to Report No. BK50222. (Report No. BK20230). John M. Dorsey. [nd]. 1p. COAXIAL CABLES AND CONNECTORS. (Report BK50239; N-1282d). Barton L. Weller. June 1, 1944. 10p. Decl. Nov. 28, 1955. $3.30(ph OTS); $2.40(mf OTS).

Effect of aquadag coating on noise reduction in polyethylene coaxial cable was tested. A satisfactory combination of coaxial cables and connectors for interconnecting sources of small ion currents or ionizing impulses with the measuring device is described. (G.Y.)

**5255** KLX-66

Kellex Corp., New York.

DETAILED PROJECT STATUS REPORT [ON] PUMP SURVEY. Job 11. Sept. 16, 1949. Decl. Jan. 9, 1956. 19p. Contract AT-30-1-gen-169. $6.30(ph OTS); $3.00 (mf OTS).

Tests were made in Kellex-designed machines of various types of bearings and many bearing materials. (L.M.T.)

**5256** ORNL-836

Oak Ridge National Lab., Tenn.

GENERAL REACTOR-ENGINEERING RESEARCH QUARTERLY PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1950. R. N. Lyon, ed. Nov. 13, 1950. Decl. Jan. 17, 1956. 46p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

It was found that MO concrete deteriorates on aging, particularly in wet or humid surroundings. This plus a lack of uniformity in the commercial ingredients led to the decision not to initiate new studies on MO. The compressive strength, thermal conductivity, specific heat, linear expansion and water absorption properties of barytes concrete were measured. In addition, the water absorption of ordinary concrete and of limonite concrete were measured. Small sheets of boron carbide in plastisols exhibited superior physical properties to boron carbide in Tygon. A large $56\frac{1}{2}$ in. × $66\frac{1}{2}$ in. sheet of the latter was successfully fabricated. A large Boral sheet, 52 in. × 92 in. × $\frac{3}{16}$ in., was successfully rolled. Boral was sprayed onto mild steels, but the bond with the base metal was weak and needs further development. Mechanical properties of 34 plastics were obtained as a function of total irradiation in the X-10 reactor. These are reported. Some data on other more resistant plastics were also obtained as well as information on electrical properties and the effects of fast neutron and pure gamma irradiation. (auth)

## MINERALOGY, METALLURGY, AND CERAMICS

### CERAMICS AND REFRACTORIES

**5257** CC-2664

[California. Univ., Berkeley. Radiation Lab.]

THE EFFECT OF IMPURITIES UPON SULFIDE REFRACTORIES. L. Brewer, L. A. Bromley, P. Gilles, and N. Lofgren. Jan. 20, 1945. Decl. Dec. 15, 1955. 18p. Contract W-7405-eng-48B. $3.30(ph OTS); $2.40(mf OTS).

A summary of the effect of metal, C, Si, and $O_2$ impurities upon the various sulfide refractories is given and the proper procedures for elimination of the impurities are discussed. CeS which is properly prepared can be handled in air without danger of catching fire or appreciable oxidation. 650 satisfactory crucibles have been made to date using sulfides which were screened and pressed in air with less than 0.5% oxygen pickup. The other Ce and Th sulfides are even more inert to oxidation than is CeS. Phase diagram possibilities are discussed for the Ce and Th sulfide and oxysulfide systems. Further study of ThS has shown that ThS crucibles are the highest melting and the least volatile of the sulfide crucibles and ThS may be used for remelting of some metals up to 2000°C. ThS crucibles appear to be the most suitable containers for metal reductions. (auth)

**5258** CC-3524

Chicago. Univ., Metallurgical Lab.

THE PREPARATION OF HIGH-PURITY BERYLLIUM OXIDE. F. S. Tomkins, G. W. Cressman, and L. J. Tolmach. May 27, 1946. Decl. Dec. 22, 1955. 5p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80(mf OTS).

A method for the preparation of BeO of high purity is presented. Beryllium basic acetate ($BeO \cdot 3Be(C_2H_3O_2)_2$) is prepared from the metal or a convenient salt, a chloroform solution of this material extracted with redistilled water, the dried basic acetate distilled in a quartz apparatus, and this purified material converted to the oxide by fuming down with $H_2SO_4$ and igniting at 1000°C. Impurities detectable spectrographically were reduced to a very low level. (auth)

### CORROSION

**5259** AECD-3839

General Electric Co. General Engineering and Consulting Lab., Schenectady, N. Y.

CORROSION INVESTIGATION. Edward Long. Sept. 28, 1948. Decl. Dec. 22, 1955. 38p. Contract W-31-109-eng-52. (EAH-52). $6.30(ph OTS); $3.00(mf OTS).

Corrosion data are summarized on stainless steels, various metallic materials, some non-metallic materials,

and a number of plastics. In general, each material was given an agitator and vapor corrosion test, and some materials were also given an alternate immersion test. Greases and a mixed acid were used as corrosive media. (B.J.H.)

**5260** AECD-3962
Tennessee Eastman Corp., Oak Ridge, Tenn.
CORROSIVITY OF URANYL FLUORIDE TO CERTAIN METALS. L. F. Little and C. D. Susano. Sept. 19, 1946. Decl. Dec. 20, 1955. 4p. Contract W-7401-eng-23. (C-3.370.8). $1.80(ph OTS); $1.80(mf OTS).

The results obtained from the tests conducted for the purpose of determining the corrosivity of a 30% solution of uranyl fluoride to various metals indicate that stainless steels (type 302, 304, 321 and 316) have very good resistance, while monel, nickel and aluminum, respectively, exhibit diminishing resistance. Stainless steel, type 316, was the most resistant of the specimens tested. (auth)

**5261** CT-2715
[Ames Lab., Ames, Iowa].
WATER CORROSION OF ALLOYS OF THORIUM AND OF URANIUM. Problem Assignment No. 16. J. G. Feibig. Apr. 25, 1945. Decl. Jan. 4, 1956. 14p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

A study of the water corrosion of Th, U, and Th–Be, Th–Fe, U–Be, and U–Ta alloys was made. Values obtained by polishing the sample with either a nonmetal-cutting cloth or an abrasive wheel were more reliable than those obtained by other methods. The coupling of Al and Th was found to have little effect on the corrosion rate of Th. Increased temperature caused an increase in the rate of corrosion while solutions containing acid and dissolved salts caused a partial disintegration of the samples. Alloys of Th were found to be less resistant to corrosion than was the unalloyed metal. No alloy of U was found to be sufficiently resistant to corrosion. All of them partially disintegrated during the tests. (G.Y.)

**5262** KLX-71
Kellex Corp., New York.
CONCRETE COATING MATERIALS. Detailed Project Status Report. Job 11. Sept. 23, 1949. Decl. Jan. 10, 1956. 13p. Contract AT-30-1-Gen-169. $3.30(ph OTS); $2.40(mf OTS).

Industrial vinyl copolymer resin paints were found to provide satisfactory waterproof coatings for the concrete walls. They were found to have sufficient corrosion resistance to warrant their consideration for other applications, especially since they are less expensive and are easier to prepare than flame sprayed plastics. (L.M.T.)

Refer also to abstract 5406.

## METALS AND METALLURGY

**5263** AECD-3884
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT FOR APRIL, MAY AND JUNE 1951. W. E. Dreeszen. Aug. 15, 1951. Decl. with deletions Jan. 5, 1956. 53p. Contract W-7405-eng-82. $9.30(ph OTS); $3.60(mf OTS).

**5264** AECD-3904
Mallinckrodt Chemical Works, St. Louis.
A REPORT ON AN EMPERICAL RELATION BETWEEN THE NITROGEN, CARBON AND DENSITY OF RECAST URANIUM METAL. W. A. Oppold and B. D. Field. Nov. 24, 1947. Decl. Dec. 8, 1955. 9p. (MCW-A-77). $1.80(ph OTS); $1.80(mf OTS).

The equation R = 19.21−0.000874N−0.000484C gives an emperical relation between the nitrogen and carbon content and the density of recast uranium metal. The results obtained by using this relation are within the analytical error and any value calculated from the equation can be checked in the laboratory. A nomograph is given for ease in determining the third value when the other two values are kr n. (D.E.B.)

**5265** AECD-3929
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1950. W. E. Dreeszen. Jan. 30, 1951. Decl. with deletions Jan. 5, 1956. 50p. Contract W-7405-eng-82. $7.80(ph OTS); $3.30(mf OTS).

**5266** AECD-3977
Metal Hydrides Inc. Chemical Research Lab., Beverly, Mass.
THE SODIUM–HYDROGEN SYSTEM. J. J. McSharry, E. A. Sullivan, R. W. Bragdon, and M. D. Banus. Jan. 1, 1954. Decl. with deletions Dec. 7, 1955. 21p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 390. $0.20(OTS).

The equilibrium pressure of H over the Na–H system has been measured as a function of the H content of the condensed phase. Measurements have been over the range of 500 to 600°C, and at pressures of 15 to 4,000 cm., and the results are plotted in the forms of isotherms and isocomps. In the composition range of approximately 25 to 90 mole per cent sodium hydride, the isotherms are essentially horizontal, and the dissociation pressures agree very well with those obtained by extrapolation of the values reported by Herold to isotherm temperatures. At the low composition end of the isotherms, the dissociation pressures drop smoothly to zero pressure at pure sodium. At the high-composition end, the dissociation pressures rise sharply and approach the 100 mole per cent sodium hydride nearly asymptotically. These departures from the horizontal represent regions where sodium and sodium hydride are completely soluble in each other. The isocomps are a family of straight lines and permit calculation of free energy, heat, and entropy of dissociation of sodium hydride. Problems encountered in containing sodium and sodium hydride under these conditions are reported. (auth)

**5267** AECD-4001
Ames Lab., Ames, Iowa.
PROGRESS REPORT IN METALLURGY, APRIL 1, 1949 TO SEPTEMBER 30, 1949. Nov. 15, 1949. Decl. with deletions Jan. 5, 1956. 25p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

**5268** AECD-4023
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT FOR JULY, AUGUST, AND SEPTEMBER 1951. W. E. Dreeszen. Nov. 15, 1951. Decl. with deletions Jan. 5, 1956. 59p. Contract W-7405-eng-82. $9.30(ph OTS); $3.60(mf OTS).

**5269** AECD-4036
[Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.]
COMPARISON OF BRUSH PROCESS "Q" BERYLLIUM WITH EXTRUDED CAST BERYLLIUM, EXTRUDED FLAKE, AND EXTRUDED TURNING. Paul Gordon. Nov. 8, 1946. Decl. Jan. 11, 1956. 16p. (MIT-PG-1). $3.30 (ph OTS); $2.40(mf OTS).

An investigation was conducted to compare some physical and chemical properties of Brush Be bars made by their process "Q" with those of extruded bars made from cast metal, from compressed Clifton flake metal, and from compressed turnings resulting from machining of previously extruded cast metal. Three Brush bars, each about 9" in length and 3/4" in diameter were received. No

detailed information was furnished as to the exact nature of process "Q," but it is evidently a powder metallurgy process based upon sintering of compacted Be powder. (auth)

**5270** AECD-4046
Ames Lab., Ames, Iowa.
SEMI-ANNUAL PROGRESS REPORT IN METALLURGY FOR THE PERIOD OCTOBER 1, 1950–MARCH 31, 1951. H. A. Wilhelm. May 1, 1951. Decl. with deletions Jan. 9, 1956. 60p. Contract W-7405-eng-82. $9.30(ph OTS); $3.60(mf OTS).

**5271** AECD-4050
Battelle Memorial Inst., Columbus, Ohio.
THE PREPARATION OF URANIUM FOIL. H. A. Saller and J. R. Keeler. Oct. 1, 1948. Decl. with deletions Nov. 22, 1955. 10p. Contract W-7405-eng-92. $1.80(ph OTS); $1.80(mf OTS).

Uranium foil 0.001 inch thick was made by rolling cast specimens at 600°C. in a steel jacket and cold rolling the resulting 0.012-inch-thick strip to the desired thickness. The foil was of excellent quality, having no pin holes and only very slight edge cracking. (auth)

**5272** AECD-4059
Nuclear Development Associates, Inc., White Plains, N. Y.
THERMAL CONDUCTIVITY OF URANIUM–CHROMIUM AND URANIUM–IRON EUTECTIC ALLOYS. John M. McKee, Jr. Apr. 14, 1953. Decl. Jan. 10, 1956. 26p. (NDA-14-12).

Work performed under contract with the Detroit Edison Co. and the Dow Chemical Co. $4.80(ph OTS); $2.70(mf OTS).

Thermal conductivity and heat capacity measurements on the U–Cr and U–Fe eutectic alloys were obtained at room temperature. These measurements were intended to provide approximate values only, for use in design calculations until more accurate data in the temperature range of interest becomes available. The thermal conductivities were measured under transient heat flow conditions—a method requiring a minimum of time and equipment and giving sufficient accuracy for the purpose. The measured conductivity of the U–Cr alloy agrees well with the value calculated from the conductivity of the pure component elements by Tareef's equation, suggesting that this same equation can be used to predict conductivities at higher temperatures. If this assumption is valid, the thermal conductivity of the U–Cr eutectic will be relatively constant from room temperature up to 600°C. (auth)

**5273** BMI-798
Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL PROPERTIES OF ZIRCONIUM–TIN ALLOYS. A. D. Schwope and W. Chubb. Dec. 22, 1952. Decl. Dec. 13, 1955. 21p. Contract [W-7405-eng-92]. $3.30(ph OTS); $2.40(mf OTS).

The mechanical properties and corrosion resistance of induction-melted, Zr–Sn alloys have been determined. The alloys investigated contained from 0 to 0.5% Sn and up to 0.3% C. The Zr used was Bureau of Mines sponge. The mechanical properties investigated include the tensile, hot-hardness, and impact properties. (auth)

**5274** CK-1130
Chicago. Univ. Metallurgical Lab.
METALLURGY OF 94. REPORT FOR MONTH ENDING DECEMBER 10, 1943. C. M. Cooper, A. B. Greninger, and T. T. Magel. [nd] Decl. Dec. 14, 1955. 10p. (A-1618). $3.30(ph OTS); $2.40(mf OTS).

Progress is reported on the production and deposition of U metal. Ceramic research on the preparation of crucibles to be used in the production of U is also discussed. (B.J.H.)

**5275** CT-611
Battelle Memorial Inst., Columbus, Ohio.
METALLURGY OF TUBALLOY [URANIUM]. Progress Report to University of Chicago. Apr. 10, 1943. Decl. Dec. 13, 1955. 41p. $4.80(ph OTS); $2.70(mf OTS).

Data are included on the hot extrusion of U, drop hammer tests on U at high temperatures, U coating methods, the amount of H evolved from Al jacketed U metal and the metallography of U. (B.J.H.)

**5276** CT-1515
Ames Lab., Ames, Iowa.
METALLURGICAL RESEARCH REPORT FOR PERIOD OF FEBRUARY 1 TO MARCH 10, 1944. Mar. 25, 1944. Decl. Dec. 14, 1955. 13p. Contract [W-7405-eng-82]. (A-2094). $3.30(ph OTS); $2.40(mf OTS).

**5277** CT-1780
[Ames Lab., Ames, Iowa]
METALLURGY [REPORT] FOR PERIOD JUNE 10 TO JULY 10, 1944. Aug. 9, 1944. Decl. Dec. 15, 1955. 25p. Contract [W-7405-eng-82]. (A-2609). $4.80(ph OTS); $2.70(mf OTS).

**5278** CT-1985
[Ames Lab., Ames, Iowa]
TECHNOLOGICAL RESEARCH—METALLURGY [REPORT] FOR PERIOD OCTOBER 10 TO NOVEMBER 10, 1944. Jan. 4, 1945. Decl. Dec. 14, 1955. 27p. (A-3023). $4.80(ph OTS); $2.70(mf OTS).

Preparation of BeO, MgO, $ZrO_2$, $UO_2$-base crucibles; phase studies on U–Ta, U–Mo, U–Th, and Be–Th; metallographic studies on oxide and carbide inclusions in Th metal; production of massive Be by Ca reduction of $BeF_2$ with $PbCl_2$ booster; production of Ce by Ca reduction of $CeCl_3$ with iodine booster; production of Th–Zn alloy by Ca reduction of $ThF_4$–$ZnCl_2$; and production of Be–Th alloys by Ca reduction of $BeF_2$–$ThF_4$ were investigated. (G.Y.)

**5279** CT-2374
Battelle Memorial Inst., Columbus, Ohio.
METALLURGY OF TUBALLOY. Progress Report to University of Chicago. Nov. 1, 1944. Decl. Dec. 13, 1955. 31p. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on dilatometric and x-ray-diffraction studies and the metallographic examination of U–Mo alloys. A study was made of pimple formation on U metal treated at 450°C in vacuum. Beta-phase rolling data are given. Progress is also reported on coating U metal with Mo. Annealing data are included. (B.J.H.)

**5280** ISC-45
Iowa State Coll., Ames.
PROGRESS REPORT IN METALLURGY [FOR] OCTOBER 1, 1948 TO MARCH 31, 1949. B. A. Rogers. May 5, 1949. Decl. Jan. 5, 1956. 28p. Contract [W-7405-eng-82]. $4.80(ph OTS); $2.70(mf OTS).

Progress is summarized on production of Th, Be and Zr; determination of vapor pressure of Ce; phase studies of Th–Zr, Th–C, and Zr–U alloys; preparation of $VF_3$; and separation of MsTh($Ra^{228}$) from Th metallurgical wastes. The information has been recapitulated in later reports or has been published as separate items. (G.Y.)

**5281** KLX-1744
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES—NUCLEAR ASPECTS. Quarterly Progress Report [for] November 1, 1954–January 31, 1955. Job 2018 (Formerly Job 1099). J[ames] J. Shyne, H. N. Barr, W. D. Fletcher, and H. G. Schelble. Feb. 21, 1955. Decl. Jan. 6, 1956. 22p. Contract AT(30-1)-850. $3.30(ph OTS); $2.40(mf OTS).

A study was made of the densification of porous metallic

coatings produced by hydrogen reduction of metallic oxides. Mechanical working methods of the coatings, viz., rolling, ball burnishing and spinning, all produced coatings with notable increases in density, and in some cases the coatings were completely pore-free. Rolling of coatings after low-temperature reduction gave better surface structure than coatings that were first sintered at high temperatures. Attempts to eliminate porosity by increased sintering in a hydrogen-halogen atmosphere or in a hydrogen–CO atmosphere were unsuccessful. Also, vacuum impregnation of the porous coating with a water dispersion of reducible oxides resulted in only minor reduction in porosity. The recording electromagnetic balance has been used to evaluate the effect of temperature on deposition rate of electrophoretic dispersions. About 40°C is the upper temperature limit by which the plating rate is increased, above this the rate declines sharply. Severe cracking of the deposited coating can be attributed to shrinkage during drying of the solvent. It was found that particle size will influence the extent of cracking due to shrinkage and so steps are being taken to adjust the particle distribution from 1 to 5 microns in diameter. Dispersion formulations presently include a binder, resin and plasticizer in a suitable solvent of sufficient concentration to bind the particles to one another and to the substrate. With these formulations, cracking of the deposit was lessened and heavier deposits were obtainable. (auth)

**5282** LAMS-289

Los Alamos Scientific Lab., N. Mex.

CONSOLIDATION AND SHAPING OF BORON. Summary of Previous Work. Robert Kamm. Oct. 8, 1945. Decl. Dec. 12, 1955. 14p. Contract [W-7405-eng-36]. $3.30 (ph OTS); $2.40(mf OTS).

The following boron fabrication methods are summarized: consolidation of boron powder with unreactive bonding agents (Pb, $B_2O_3$, S, cements, etc.); consolidation of B powder with reactive bonding agents (metals); hot pressing of boron carbide; consolidation of pure B; reduction; and high-vacuum evaporation. (C.W.H.)

**5283** M-3105

[Iowa State Coll., Ames.]

THE URANIUM–CARBON SYSTEM. E. A. Wilhelm, A. H. Daane, J. H. Carter, and A. I. Snow. [1945?]. Decl. Jan. 11, 1956. 35p. Contract [W-7405-eng-82]. $6.30(ph OTS); $3.00(mf OTS).

A constitutional diagram of the uranium–carbon system has been constructed from metallographic, thermal, chemical and x-ray data. Two compounds UC (4.8 wt.% carbon) and $UC_2$ (9.16 wt.% carbon) have been identified and a compound stable only at high temperatures, $U_2C_3$ (7.03 wt.% carbon) has been proposed. No compound of carbon content higher than 9.16 wt.% is believed to exist. The solubility of carbon in liquid uranium up to 1800°C is small (less than 0.60 wt.%) but the solubility increases rapidly thereafter for a slight rise in temperature. The gamma-beta and beta-alpha uranium transformations are not affected by the presence of carbon. Two solid solution phases are believed to exist; delta in the 7.0 wt.% region and gamma in the 9.16% region. These phases are apparently stable only at high temperatures and break down into two phases (UC and $UC_2$) at lower temperatures. UC has a cubic structure of the NaCl type $a_0 = 4.940 \pm 0.001$ A. $UC_2$ is tetragonal $LaC_2$ type $a = 4.974 \pm 0.001$ A, $c = 5.987 \pm 0.001$ A. (auth)

**5284** M-3106

[Iowa State Coll., Ames.]

THE URANIUM–THORIUM SYSTEM. O. N. Carlson, A. H. Daane, and A. S. Wilson. [1945?]. Decl. Jan. 11, 1956. 10p. Contract [W-7405-eng-82]. $1.80(ph OTS); $1.80(mf OTS).

Thermal, chemical, microscopic and x-ray methods were employed to work out the uranium–thorium constitutional diagram. This system is of the simple eutectic type with complete liquid miscibility and complete heterogeneity in the solid state. No evidence was found of any solid solubility of either metal in the other. The thorium-rich liquidus was not observed in any thermal data which has been found to be the case with other thorium alloys as well as with pure thorium. (auth)

**5285** M-3107

[Iowa State Coll., Ames.]

THE URANIUM–TIN SYSTEM. D. A. Treick, J. H. Carter, A. I. Snow, R. R. Baldwin, and A. S. Wilson. [1945?]. Decl. Jan. 11, 1956. 18p. Contract [W-7405-eng-82]. $3.30(ph OTS); $2.40(mf OTS).

The uranium-tin system was studied by thermal, chemical, x-ray, and microscopic methods. The compound $USn_3$ (60% Sn), which decomposes peritectically at 1350°C, was identified and two compounds were observed whose exact compositions have not been determined because of the extremely pyrophoric nature of the samples which prevented careful study of the microstructures and x-ray analysis. It is known that these two compounds, probably $U_3Sn_4$ and $U_3Sn_5$, melt above 1350°C. No solid solubility of either metal in the other was observed. (auth)

**5286** M-3752

Clinton Labs., Oak Ridge, Tenn.

PILE TECHNOLOGY. BERYLLIUM OXIDE. LECTURE 19. R. O. Brittan and W. L. Sibbitt. Feb. 14, 1947. Decl. Jan. 10, 1956. 29p. $6.30(ph OTS); $3.00(mf OTS).

The sources of beryllia are briefly discussed including data on commercially available ores, reserves, production and imports, and prices. Several processes for obtaining BeO from beryl are outlined. The various grades of BeO powder available are listed. Complete data are given on the physical properties of BeO including single crystal properties, density, hardness, heat capacity, elastic modulus, electrical resistivity, thermal expansion, heat conductivity, crushing strength, tensile strength, thermal stability, vapor pressure, emissivity, and chemical attack. The uses and fabrication of BeO are also surveyed. The properties of BeO–uranium oxide mixtures are also discussed. Also included are brief discussion on BeO impregnation of fuel units, nuclear data, and radiation effects. (B.J.H.)

**5287** M-3989

Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.

PROGRESS (A-1) REPORT FOR APRIL AND MAY 1947. Decl. Jan. 12, 1956. 51p. Contract W-7405-eng-175. $7.80(ph OTS); $3.30(mf OTS).

The large crystals of Be which develop in slowly cooled castings may be a convenient source of single crystals. Distillation of Be is an effective means of removing B from the metal. A considerable reduction in Fe is possible, but Al and Si will be more difficult to remove. Zirconium is not corroded appreciably by water at temperatures up to 180°C. Tensile tests on Be at 350°C were conducted at strain rates varying from 0.01 to 3.5 inches per minute of cross-head speed. Over this range there were definite increases in strength and decreases in ductility with increased speed, but the effects were fairly small. Extruded-flake Be is stronger than vacuum-melted metal below 400°C, but is weaker than the latter above 400°C. Beryllium containing 2% U has much greater stress-rupture strength than pure Be at 2000°F. Hot torsion tests on extruded Be at temperatures up to 1000°C were carried out at one rate of testing. The yield strength decreases continuously with increasing temperature, while the maximum torque first rises to a maximum at about 200°C before

decreasing. The maximum twist before failure increases up to about 400°C and then remains approximately constant up to 1000°C. Improved extrusion of Be was achieved by using a thin electroplated layer of Cu outside of the regular Fe jacket. Steep-sided Fe cones located outside of the billets also gave good results. Beryllium is so stiff at the extrusion temperature that the metal does not readily flow into corners on complex shapes. A new type of roller die indicated that a large reduction in extrusion pressure can be achieved in this way. (auth)

**5288** MIT-1029(Pt.I)
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
TECHNICAL PROGRESS REPORT [FOR] JANUARY THROUGH JUNE 1949. Sept. 16, 1949. Decl. Jan. 12, 1956. 145p. $22.80(ph OTS); $7.20(mf OTS).

Progress is reported on the reduction, purification, fabrication, and tensile properties of Be and on the reduction, purification, and fabrication of Zr. Data are also given on the corrosion of Be, Zr, Al, and Nb in distilled water. The hot pressing of Be and beryllium oxide bodies is discussed. (B.J.H.)

**5289** MIT-1029(Pt.II)
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
TECHNICAL PROGRESS REPORT [FOR] JANUARY THROUGH JUNE 1949. Sept. 16, 1949. Decl. Jan. 17, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

The tensile strength of uranium extruded at various temperatures in the alpha phase was determined. A variation of Young's modulus from 14 to 26 million psi was observed. The density of uranium in the alpha and beta phases was studied but without clear-cut results. (auth)

**5290** MIT-1034(Pt. I)
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
TECHNICAL PROGRESS REPORT FOR THE PERIOD JULY THROUGH SEPTEMBER 1949. A. R. Kaufmann. Oct. 26, 1949. Decl. Jan. 12, 1956. 81p. $13.80(ph OTS); $4.80(mf OTS).

The addition of 0.1 to 0.25% Al to Be appears to greatly increase the probability that an 8 in. diameter billet casting will be free of internal cracks. The transverse tensile strength of 3 in. × 3 in. Be extrusions made from 8 in. diameter billets is only about 10,000 psi even on annealed pieces containing no apparent defects. Samples of sintered Be powder made by the Brush Company and then extruded at M.I.T. exhibited tensile strengths as high as 100,000 psi with elongations up to 12%. Small pieces of ductile V made by Knolls Atomic Power Lab. were extruded into an apparently sound bar. The production of massive crystal bar Zr by passing $ZrI_4$ vapor over induction-heated metal was studied. Zirconium was melted without apparent contamination by induction heating the end of a bar suspended in high vacuum and collecting the drippings in a Cu cup. The corrosion resistance of crystal bar metal is not changed by this operation. Zirconium tubing with small I.D. and thin wall can be made by extrusion and drawing. It was established by x-ray-diffraction that a new phase exists in Zr–U alloys in the range 20 to 50% U. The phase relationships were established. The corrosion resistance of Bureau of Mines sponge Zr may be greatly improved as compared with the graphite-melted metal by a high-vacuum high-temperature heating. Results indicate that C, $N_2$, and Ti greatly reduced the corrosion resistance of Zr to 300°C water, while $O_2$ has only a small effect. (auth)

**5291** MIT-1045(Pt. I)
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
TECHNICAL PROGRESS REPORT FOR THE PERIOD JANUARY THROUGH MARCH 1950. A. R. Kaufmann. May 16, 1950. Decl. Jan. 12, 1956. 60p. Contract W-7405-eng-175. $9.30(ph OTS); $3.60(mf OTS).

Tensile tests were carried out on cast and extruded Be at various temperatures up to 1000°C and at deformation rates of 1 in. and 42 in. per minute. A device for continuously melting and casting a metal in a crucible made of the same metal is described. This auto-crucible procedure gave promising results on stainless steel. Zirconium powder was extruded into a solid bar. This material exhibited a tensile strength of about 120,000 psi with 6% elongation. The oxygen content was 0.35%. The metal exhibited poor corrosion resistance in 300°C water. The extrusion and subsequent rolling of Bureau of Mines sponge Zr was carried out without difficulty. Corrosion studies of Zr with added Al indicate that the corrosion resistance is rapidly decreased when the Al content exceeds about 200 ppm. It was shown that ordinary Bureau of Mines sponge after drip melting contains excessive amounts of Al, but the "C" sponge is consistently low in Al and exhibits corrosion resistance as good as crystal bar. (auth)

**5292** N-381
[Chicago. Univ. Metallurgical Lab.]
DETECTION OF FAULTY WELDS BY X-RAYS. E. C. Creutz. Dec. 15, 1943. Decl. Jan. 13, 1956. 8p. Contract [W-7401-eng-37]. (MUC-EC-52). $1.80(ph OTS); $1.80(mf OTS).

The feasibility of detecting faulty welds in slug jackets by x rays is discussed, and several examples are shown. (B.J.H.)

**5293** NYO-1126
Sylvania Electric Products, Inc., Bayside, N. Y.
THE TENSILE PROPERTIES OF ZIRCONIUM AT ELEVATED TEMPERATURES. D. R. Brunstetter, H. P. Kling, and B. H. Alexander. Apr. 4, 1950. Decl. Dec. 5, 1955. 18p. $0.20(OTS).

Values of yield strength, tensile strength, elongation, and Young's Modulus were determined on Zr wire at temperatures ranging from 70 to 1000°F. (auth)

**5294** SEP-33
Sylvania Electric Products Inc., Bayside, N. Y.
THE PROCESS OF PULSE SINTERING. Bernard Kopelman. Dec. 22, 1949. Decl. Dec. 6, 1955. 12p. Contract AT-30-1-Gen-366. $0.15(OTS).

The process of pulse sintering is described whereby metal powders or their mixtures are simultaneously pressed and sintered in a matter of seconds to yield materials of essentially theoretical density. This is accomplished by passing momentary surges of electrical current through the pressed compact while the pressure is being applied. The resulting material shows a grain size essentially that of the particle size of the starting powder, with complete random orientation of the grains. Several examples of the usefulness of this method to problems of interest in the atomic energy program are discussed and photomicrographs depict the results that may be obtained. (auth)

**5295** SO-3002
Rensselaer Polytechnic Inst., Troy, N. Y. Powder Metallurgy Lab.
ELECTRIC RESISTANCE SINTERING. A. B. Backensto, Jr., N. F. Hopson, and F. V. Lenel. Jan. 31, 1951. Decl. Jan. 5, 1956. 28p. Contract AT-(30-3)-37. $4.80(ph OTS); $2.70(mf OTS).

Composite compacts ½ in. in diameter with a case of pure Al and a core of U–Al can be extruded at 750°F with core mixes of 50, 60, 70, and 80% by weight of –325 mesh U powder and the remainder –325 mesh Al powder. At present, 80% U in the core mix is the maximum that can be extruded. Pressing 1½-in. diam composite compacts with a

core of 70% Fe and 30% Al and a $\frac{1}{8}$-in.-thick case of pure Al has been modified to maintain an even case thickness. Examination of 750°F extrusion tests indicates that surface cracks are now caused by segregation of Fe particles during pouring. Hardness and ductility of resistance sintered Zr compacts are improved by compacting in an inert atmosphere. These compacts can be cold-rolled up to 42% before developing cracks. Mixtures of boron carbide and carbonyl nickel powder can be resistance sintered to satisfactory density if they contain a minimum of 40% by volume of metal. (auth)

**5296** Y-868
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
MTR BERYLLIUM MACHINING HISTORY. J. M. Case, E. R. Watkins and F. S. Jones. Apr. 22, 1952. Decl. Dec. 6, 1955. 22p. W-7405-eng-26. $0.20(OTS).

Beryllium machining for the Materials Testing Reactor was effected by the Y-12 Maintenance Division. This report summarizes safety considerations, dust control methods, and machining techniques applied during the course of the reflector fabrication. (auth)

Refer also to abstract 5207.

# PHYSICS

**5297** ANL-4092
Argonne National Lab., Lemont, Ill.
PILE RESEARCH AND DEVELOPMENT DIVISION REPORT FOR PERIOD MARCH 1, 1947 THRU NOVEMBER 30, 1947. Dec. 22, 1947. Decl. Dec. 13, 1955. 38p. Contract W-31-109-eng-38. $6.30(ph OTS); $3.00(mf OTS).

Refer also to abstract 5271.

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

**5298** MIT-1063
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
A RECRYSTALLIZATION STUDY OF RADIATION DAMAGE IN ALUMINUM. W. B. Nowak. Apr. 13, 1951. Decl. Jan. 13, 1956. 12p. Contract AT(30-1)-981. $3.30(ph OTS); $2.40(mf OTS).

Single crystals, prepared from both 2S and 99.99% pure aluminum, have been irradiated with fast neutrons. A schedule of polishing, etching, examining, and heat treating at successively higher temperatures was carried out. No recrystallization was observed with annealing schedules carried from 160 to 650°C. The maximum number of estimated fast-neutron collisions was $2 \times 10^{16}$ per sample. (auth)

## GASES

**5299** MonN-27
[Clinton Labs., Oak Ridge, Tenn.]
THE CHEMISTRY OF GAS AND PEROXIDE FORMATION INDUCED BY RADIATION IN WATER SOLUTIONS: SURFACE PROPERTIES OF PALLADIUM CATALYSTS. Problem Assignment No. CX5-7. A. R. Brosi. Oct. 24, 1945. Decl. Jan. 11, 1956. 15p. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

No exchange was observed between $Pd^{2+}$ and Pd surface after 17 hr. However, under certain conditions Pd adsorbs sufficient $Pd^{2+}$ (2.35 mg/m$^2$) to form a monolayer on the surface. Electron photomicrographs and electron diffraction patterns indicate that Pd particles as small as 100 to 200 A in diameter are face centered cubic crystals with cube faces. Activated alumina, charcoal, and carbon blacks adsorb enough Pd (1 to 5%) to be of possible interest as catalyst supports. The Pd adsorption per unit area by these supports (0.04 to 0.07 mg/m$^2$) is much less than by Pd. (auth)

**5300** MonT-221
[Clinton Labs., Oak Ridge, Tenn.]
ADSORPTION OF XENON ON CHARCOALS. Progress Report—Problem Assignment No. TX5-12. J. R. Donovan. Dec. 13, 1946. Decl. Jan. 10, 1956. 19p. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

Preliminary, indirect measurements of the adsorption equilibrium and rate of adsorption of tracer quantities of xenon in oxygen have been made in a dynamic system using Magnesols, granular magnesia, silica gel, and activated carbon as adsorbents. Activated carbon was found to be markedly the best adsorbent and the effects of gas velocity, temperature, thickness of adsorbent bed, and partial pressure of xenon were studied for that material. In the range studied, the partial pressure of xenon did not affect the relationship of the other variables to the rate of adsorption. Expressions were obtained for F, the fraction of entering material adsorbed by a column of adsorbent at any time, and $F_0$, the fraction adsorbed at the start. (auth)

Refer also to abstract 5135.

## INSTRUMENTS

**5301** A-3625
Carbide and Carbon Chemicals Corp., Oak Ridge, Tenn.
A BATTERY-LESS ELECTRONIC REGULATED POWER SUPPLY. Jerome Aristei. Jan. 14, 1946. Decl. Jan. 17, 1956. 17p. $3.30(ph OTS); $2.40(mf OTS).

In order to prevent power supply failures, it was proposed that the batteries be replaced with a glow discharge tube VR 105/003 operating at about 200 $\mu$ amperes. Proposed circuit diagrams are given. (B.J.H.)

**5302** A-3845
Columbia Univ., New York. Pupin Physics Labs.
ELECTROMETER INPUT CONDENSERS WITH NEGLIGIBLE LEAKAGE. L. J. Rainwater, H. A. Glassford, and C. S. Wu. Mar. 30, 1946. Decl. Jan. 17, 1956. 9p. Contract W-7405-Eng-50. (DR-722). $1.80(ph OTS); $1.80(mf OTS).

Modifications made in a commercially available condenser are described which transform it into a suitable condenser for rate of drift operation with an inverse feedback electrometer circuit. (C.H.)

**5303** AECD-3868
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
BETA MAGNET CURRENT STABILITY. E. D. Hudson and M. C. Becker. July 8, 1947. Decl. Dec. 6, 1955. 12p. (A-6.465.2). $4.80(ph OTS); $2.70(mf OTS).

A TEC regulator amplifier driving an Esterline-Angus recording meter was used to record magnet current variations. Tests were made to determine magnet current stability for currents from 500 to 4000 amperes. Changes were necessary in both the TEC and GE regulators before currents below 2500 amperes could be regulated. Regulation to 0.025% for an hour was obtained for currents of 1000 to 4000 amperes with the TEC and GE regulators, and regulation to 0.05% for 500 ampere currents. (auth)

**5304** AECD-4077
Tennessee Eastman Corp., Oak Ridge, Tenn.
A DIRECT CURRENT EMISSION REGULATOR. J. R. White and A. E. Cameron. Aug. 4, 1945. Decl. Jan. 18, 1956. 4p. (B-6.460.2). $1.80(ph OTS); $1.80(mf OTS).

**5305** K-530
Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.
A PIRANI CONTROLLED PLANT LEAK FOR THE LINE RECORDER. R. W. Schede. Jan. 6, 1950. Decl. Dec. 27, 1955. 27p. Contract [W-7405-eng-26]. (S-191). $0.25 (OTS).

A Pirani controlled plant leak for the Line Recorder has been developed and has been field tested with favorable results. The results of these tests show that the system will maintain a constant Pirani reading during normal pressure surges. It is recommended that this system be used in those positions in the plant where manually operated leaks do not give satisfactory results. (auth)

**5306** M-4470
Massachusetts Inst. of Tech., Cambridge. Servomechanisms Lab.
LOGARITHMIC SYSTEM. Engineering Report No. 52. W. M. Grim. June 21, 1949. Decl. Jan. 11, 1956. 39p. $7.80(ph OTS); $3.30(mf OTS).

The Logarithmic System consists of components arranged to provide an indication of the reactor power on a logarithmic scale and an indication and a record of the rate of rise of power on a fractional basis, or the period, of the reactor. The system operates a special, audible alarm and initiates an emergency shutdown when this rate of rise becomes too great. (auth)

**5307** MonC-37
[Clinton Labs., Oak Ridge, Tenn.]
QUICK-OPENING CAN FOR PILE EXPOSURES. Covers Work Between Periods September 1–November 1, 1945. E. R Tompkins and R. E. Garber. Dec. 7, 1945. Decl. Jan. 11, 1956. 3p. Contract W-35-058-eng-71. $3.30 (ph OTS); $2.40(mf OTS).

Complete designs are given for a quick-opening sample container for reactor exposures. The opening operation requires less than a minute, thus making it possible to open a can of highly radioactive substance without danger of overexposure. (B.J.H.)

## ISOTOPES

**5308** ANL-4182
Argonne National Lab., Lemont, Ill.
THE FORMATION AND PROPERTIES OF $U^{240}$ AND $Np^{240}$. Earl K. Hyde and Martin H. Studier. Aug. 4, 1948. Decl. Jan. 18, 1956. 11p. Contract W-31-109-eng-30. $3.30 (ph OTS); $2.40(mf OTS).

$U^{240}$, formed from $U^{238}$ by second order neutron capture, is shown to decay by $\beta^-$ emission with a half life of $14 \pm 2$ hours. Its daughter, $Np^{240}$, also decays by $\beta^-$ emission with a half life of $7.3 \pm 0.3$ min. Evidence is given for the existence of a shorter-lived isomeric state of $Np^{240}$. An ether extraction procedure used for the rapid separation of U from Np and fission products is described. A procedure for the preparation of small quantities of isotopically pure $Pu^{240}$ is outlined. (auth)

**5309** IDO-16065
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
IRRADIATION OF THORIUM 230 IN MTR. G. H. Hanson. May 11, 1953. Decl. Jan. 6, 1956. 15p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

The results of calculations which were made to determine the production of $Pa^{231}$, $U^{232}$ and fission products from irradiation of $Th^{230}$ in the MTR are recorded. These calculations were made preparatory to the evaluation of the operating hazards associated with this irradiation. When one gram of $Th^{230}$ is irradiated for 60 days, the masses (in grams) of $Pa^{231}$, $U^{232}$ and fission products present are 0.075, 0.013 and 0.002, respectively. (auth)

**5310** ORNL-1392
Oak Ridge National Lab., Tenn.
PRODUCTION OF POLONIUM 208—AUGUST 1952. Final Report on Termination of Project. Robert S. Livingston and John A. Martin. Aug. 1952. Decl. Jan. 14, 1956. 24p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Substantial progress has been made in the production of experimental quantities of $Po^{208}$ in the ORNL 86-inch cyclotron. Predicted nuclear yields are now obtained at the increased energy of the cyclotron. The production rate is over 300% higher than in October 1951. Estimates of ultimate production costs in a multi-cyclotron installation now approach $50 per curie. (auth)

## ISOTOPE SEPARATION

**5311** Y-65
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
"Q + R" OPERATION OF RECEIVERS WITH ENRICHED FEED. B. Harmatz. Oct. 20, 1947. Decl. Jan. 27, 1956. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Improved efficiencies of calutron receivers with enlarged slots and increased retentivity are reported. (K.S.)

Refer also to abstract 5128.

## MASS SPECTROGRAPHY

**5312** KLX-60
Kellex Corp., New York.
MASS SPECTROMETER RESEARCH. Detailed Project Status Report. Job 11. Sept. 16, 1949. Decl. Jan. 11, 1956. 27p. Contract AT-30-1-gen-169. $7.80(ph OTS); $3.30(mf OTS).

Two methods were developed for the introduction of solid samples in to a mass spectrometer. A continuous method introduced the sample between twin ribbons entering the high-vacuum region. The ribbons are separated within the spectrometer by rollers, and the sample is then caused to enter an ionization device. Another technique provided for non-continuous sample introduction through a series of vacuum locks. Ionization of the solid sample by electron bombardment and thermionic emission was tested. (K.S.)

**5313** KLX-1310
Kellex Corp., New York.
MASS SPECTROMETER DEVELOPMENT. First Quarterly Progress Report [for] May 1–July 31, 1950. Aug. 21, 1950. Decl. Jan. 10, 1956. 27p. Contract AT(30-1) 850. $4.80(ph OTS); $2.70(mf OTS).

A vacuum lock system to permit insertion and removal of samples for a Consolidated-Nier mass spectrometer is described. The addition, modifications to the magnet, and electronic equipment are described. (L.M.T.)

**5314** KLX-1355
Kellex Corp., New York.
MASS SPECTROMETER DEVELOPMENT. Project Status Report. Job 24-B2. P. A. Stowell. Aug. 20, 1951. Decl.

Jan. 11, 1956. 40p. Contract AT(30-1)-850. $6.30(ph OTS); $3.00(mf OTS).

**5315** KLX-1388
Vitro Corp. of America, New York.
MASS SPECTROMETER DEVELOPMENT QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1–DECEMBER 31, 1952. Job 24-B2. P. A. Stowell. Mar. 30, 1953. Decl. Jan. 11, 1956. 16p. Contract AT(30-1)-850. $3.30(ph OTS); $2.40(mf OTS).

## MATHEMATICS

**5316** AECD-3972
[Oak Ridge National Lab., Y-12 Area, Tenn.]
IBM MULTIGROUP NUMERICAL PROCEDURES. D. K. Holmes and O. A. Schulze. Nov. 28, 1950. Decl. Jan. 27, 1956. 20p. (Y-F10-21). $3.30(ph OTS); $2.40(mf OTS).

This paper presents in formula form IBM computational procedures for averaging cross-section data and for calculating reflected spherical reactors by the linear multigroup numerical method. The adjoint reactor numerical procedure is included. (auth)

**5317** AECD-4047
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING OCTOBER 31, 1951. Feb. 8, 1952. Decl. with deletions Jan. 11, 1956. 28p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The background and status of various problems are reviewed. More detailed discussions are given on problems including methods of computation for use with a high-speed automatic-sequenced computer, the bounds for the maximum of a function arising in the weighting of observations, methods for treating certain second-order nonlinear differential equations, N distribution in Dictyostellium Discoideum, ferritin and hemosiderin production in livers of normal mice, indices of oxygen effect on mitosis following irradiation, and flow studies in tanks in series. (B.J.H.)

**5318** AECD-4068
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1953. W. C. Sangren, ed. Mar. 26, 1953. Decl. with deletions Jan. 11, 1956. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The background and status of various problems are reviewed. More detailed discussions are given on problems including methods of computation for use with a high-speed automatic computer, construction of subroutines for the Oracle, a test for independence in a corn genetics problem, fiducial expectation, and heat flow in long, circular pipes. (B.J.H.)

**5319** ORNL-979
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JANUARY 31, 1951. Mar. 30, 1951. Decl. Jan. 27, 1956. 43p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

The background and status of various problems are reviewed. More detailed discussions are given on problems including iterative methods for solving equations, counter statistics, evaluation of integrals, tests of homogeneity and correlation in a radiation experiment with Paramecium Aurelia, the estimation of total absorption in the blood of radiocalcium administered orally in dairy cattle, the effects of radiation on peanut plants, and the determination of neutron flux in the ORNL pile. (B.J.H.)

**5320** ORNL-1091
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JULY 31, 1951. Nov. 26, 1951. Decl. Jan. 27, 1956. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The background and status of various problems are reviewed. More detailed discussions are given on problems including counter statistics, studies on the Monte Carlo method, approximate determination of lymph space, and dose estimations from field experiments. (B.J.H.)

**5321** ORNL-1232
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1952. C. L. Perry, ed. Apr. 25, 1952. Decl. Jan. 16, 1956. 31p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The background and status of the following projects of the Mathematics Panel are noted: preparation and analysis of subroutines for the digital computer, basic studies in the Monte Carlo method, methods of computation for use with a high-speed automatic-sequenced computer, expected value of reliability of a test, analysis of temperature effects on haploid and diploid forms of Saccharomyces cerevisiae exposed to x radiation, estimation of variance components in a sterility experiment with mice, analysis of recombination percentages for several experiments with bacteriophage T2H, determination of probability distribution for a genetics experiment, irradiation effect on cell extinction, a problem in mixing, kinetics of $HBrO_3$ reaction, ion production in an ionization chamber, evaluation of the lateral distribution of energy dissipated by a moving ion, Monte Carlo estimate of collision distributions is tissue, amplifier response to proportional counter pulses, x-ray crystal analysis. Fermi functions, calculation of internal conversion coefficients with screening, calculation of Racah coefficients for the angular distribution in nuclear reactions, beta decay (field factors), estimation of error and counting periods in a pile experiment, and calibration of a calorimeter. (B.J.H)

## MEASURING INSTRUMENTS AND TECHNIQUES

**5322** A-3846
Columbia Univ., New York. Pupin Physics Labs.
GENERAL INVESTIGATIONS OF COUNTERS FILLED WITH TETRAMETHYL LEAD VAPOR. C. S. Wu and C. L. Meaker. Mar. 30, 1946. Decl. Jan. 17, 1956. 18p. Contract W-7405-eng-50. (DR-723). $3.30(ph OTS); $2.40 (mf OTS).

It was concluded that the use of tetramethyl lead for filling counters not only simplifies the filling technique but also produces counters with the qualities required of a good fast counter. Providing the proper precautions are taken to outgas the cathode, such counters have flat plateaus over as much as 200 or more volts and their characteristics do not change appreciably after as many as $10^9$ counts. The material of the cathode is unimportant as far as counter characteristics are concerned. Their resolving times are the order of $10^{-4}$ seconds although the over-all resolving time depends on the grid bias of the first tube and, to some extent, on the series resistance. The efficiency of tetramethyl lead counters is approximately the same as those filled with atmospheric helium or with argon and alcohol. (auth)

**5323** CP-2026
Clinton Labs., Oak Ridge, Tenn.
LOW GEOMETRY ALPHA PARTICLE IONIZATION CHAMBERS. Progress Report on Problem Assignment No.

231-X12AC. C. J. Borkowski, comp. Nov. 8, 1944. Decl. Jan. 27, 1956. 15p. Contract W-7405-eng-39. $3.30(ph OTS); $2.40(mf OTS).

When solutions of high specific alpha activity are to be assayed for product it is often difficult to obtain reproducible results by diluting the solution sufficiently to remove a small volume from which a sample can be prepared and counted at "52%" geometry. In order to assay such a solution, most reproducible results have been obtained with minimum effort in sample preparation by making use of low geometry chambers. Two types of low geometry chambers are described: the air-screen type which reduces the geometry simply by placing screens of various transparencies above the sample; and the vacuum low geometry chamber which accomplishes geometry reduction by increasing the distance between sample and collecting electrode thus decreasing the solid angle subtended by the sample and aperture through which the particles pass into the ionization chamber. Because the geometry of the air screen type chamber is quite critical to sample spreading and because 12 mm sample plates are required, it has found very little use. On the other hand, the vacuum chamber, because it is non-critical to sample spreading and especially non-critical to sample thickness, has found widespread use in product chemistry studies and high alpha activity experiments. Photographs and drawings are included. (auth)

**5324** CP-2245

[Chicago. Univ. Metallurgical Lab.]

A SENSITIVE PARTICLE IONIZATION CHAMBER FOR NEUTRON DETECTION. William J. Sturm and John Dabbs. Nov. 21, 1944. Decl. Jan. 27, 1956. 19p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80(mf OTS).

A particle ionization chamber of sensitivity sufficient to detect a source of one neutron per second has been used to measure the neutron yield from a thick target of S upon bombardment with Po $\alpha$ particles. The high-geometry $BF_3$ chamber used had an efficiency of 1.9% for fission neutrons. The neutron yield from a thick target of S was measured by this instrument and found to be $0.0035 \pm 0.0013$ neutrons per million incident Po $\alpha$ particles. (auth)

**5325** HW-28047

Hanford Works, Richland, Wash.

BETA IN LINE MONITOR FOR RCU STREAM. M. B. Leboeuf and R. E. Connally. May 15, 1953. Decl. Jan. 7, 1956. 6p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Interest was expressed in continuously monitoring the $\beta$ activity of the uranyl nitrate solution pumped to the RCU receiver tank, to facilitate operation at higher flow rates and with younger feeds. A $\beta$ scintillation detector was developed which should make this feasible, and it is proposed that it be tested on stream for this use. This letter is in reply to your request for information on the type of installation required. The monitor consists of a $\beta$ scintillation detector, a pre-amplifier, a counting rate meter, and a recorder, if desired. The detector element is an anthracene crystal. A $\beta$ particle emitted in the solution can penetrate the Teflon window and produce ionization in the crystal. This results in a light scintillation which is "seen" by the photomultiplier tube, thus producing an electrical pulse. A pre-amplifier increases the pulse size sufficiently so that it can be transmitted to a remote location and counted by a counting rate meter. The counting rate meter then continuously indicates the $\beta$ activity level of the solution. The response to $\beta$ and $\gamma$ radiation is fairly similar to that of a standard mica window G-M tube. It is necessary to shield the detector with lead to reduce the background counting rate. (auth)

**5326** K-418

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

CONTINUOUS BETA-GAMMA AIR MONITOR FOR K-1004-J. B. J. Bogardus. June 7, 1949. Decl. Nov. 28, 1955. 21p. Contract W-7405-eng-26. $0.20(OTS).

This report covers the design changes and the experimental data obtained on the constant air monitor for $\beta$ and $\gamma$ radiation detection in its application at the K-25 Plant. This air monitor is of the type used at the Oak Ridge National Laboratory for sampling airborne activity absorbed in dust particles etc. Problems of a practical nature involved in making the instrument more quantitative are discussed, and data needed for the application of a factor of safety to the radiation tolerance standard of the exhaust air from the stack of the K-1004-J building are suggested. (auth)

**5327** M-1772

[Rochester, N. Y. Univ.]

A RADIATION DOSE INTEGRATOR OF HIGH SENSITIVITY. Gerhard Dessauer, Kenneth E. Davis, and Fred A. White. Sept. 13, 1945. Decl. Jan. 7, 1956. 8p. Contract W-7401-eng-49. $1.80(ph OTS); $1.80(mf OTS).

An unusually sensitive radiation monitor is described which can be calibrated to measure neutron and gamma radiation over a wide range of dose rates. The device employs a specially designed ionization chamber whose characteristics are changed by varying capacity, gas type, and gas pressure. The counter is a-c operated, is self-recording, and possesses high stability and reproducibility. (K.S.)

**5328** M-3685

[Clinton Labs., Oak Ridge, Tenn.]

NEUTRON MONITORING BY MEANS OF "SPECIAL FINE GRAIN ALPHA EMULSION" FILM. J. S. Cheka. [194?]. Decl. Jan 11, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

The use of fine grain alpha emulsion film to monitor personnel for fast and thermal neutron exposure is discussed. Calibrations of the emulsion for neutrons were made in terms of proton tracks observable under a microscope of 970x magnification, and results of these determinations are tabulated. (B.J.H.)

**5329** MLM-529(Del.)

Mound Lab., Miamisburg, Ohio.

GENERAL RESEARCH REPORT FOR OCTOBER 2 TO DECEMBER 26, 1950. (Supporting Research Volume.) Jan. 29, 1951. Decl. Jan. 13, 1956. 54p. Contract AT-33-1-Gen-53. $9.30(ph OTS); $3.60(mf OTS).

An amplifier of high gain and wide dynamic range was used with a boron-wall tube to count neutrons. Plateaus and efficiency of the boron-wall tube are significantly improved by the amplifier when counting neutrons, if there are no strong gamma rays from the neutron source. The efficiency of the fast-neutron survey meter by replacing the single-chamber, methane-filled, proportional counting tube by a chamber of double the volume divided into halves. The Bradley absorption chamber is windowless and completely surrounds the sample to be countered. The accuracy of absorption measurements made with the Bradley counter was established by studies on known beta emitters. The instrument is particularly useful in waste disposal research. Sticking, drifting, and fogging of the mirror of the quartz-fiber microbalance, was significantly reduced by the reduction of moisture levels through the addition of a desiccant. Precalibration of quartz-fiber beams before their installation was shown to be practicable. Since precalibration permits installation of a beam with the correct characteristics, the average repair time was reduced from about a week to about a day. The seismic detector con-

sists essentially of a tiny mirror suspended by a five-micron quartz fiber. The Mattauch-type mass spectrograph was focused over the low mass range. The precision and accuracy of the calorimeters for specific heat measurements was investigated. An accuracy of better than 1 per cent was obtained. (auth)

**5330** ORNL-923
Oak Ridge National Lab., Tenn.
CALORIMETRIC CALIBRATION OF A GRAPHITE WALLED, CAVITY-TYPE IONIZATION CHAMBER. G. H. Jenks, W. M. Breazeale, and J. J. Hairston. Jan. 23, 1951. Decl. Jan. 11, 1956. 28p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Cavity-type ionization chambers with graphite walls were used to measure the heat dissipation in the graphite reflector of the MTR mock-up. Because of the importance of these measurements with regard to the final design of the MTR Reactor, accurate knowledge of the reliability of the heating values computed from the chamber measurements was desired. A study of the relationship between the ionization occurring in the chamber and the heat generated in the surrounding graphite medium was carried out and is reported here. The study consisted essentially of comparisons between calorimetric measurements of the heat generated in graphite placed at a chosen position in the X-pile and ionization chamber measurement carried out at a comparable position. In additional measurements made with a high intensity $Co^{60}$ source, the relative effective energies required to form ion pairs in various gases admitted separately to the ionization chamber were determined. The latter measurements made possible a comparison between the calorimetric measurements carried out in this work and the calorimetric measurements which have been carried out with the Co source by others. A comparison of the results with the best values for the average energy expended in ion pair formation in air and in $CO_2$ indicates that the chamber is about 97% efficient. This efficiency is based on the best estimate of the effective volume of the chamber. (auth)

## MOLECULAR PROPERTIES

**5331** CN-2027
Clinton Labs., Oak Ridge, Tenn.
NOMOGRAPHS FOR THE SOLUBILITY OF $BiPO_4$ IN $HNO_3$, $HNO_3-H_3PO_4$ AND $HNO_3-Bi^{+3}$ SOLUTIONS. Status Report on Problem Assignment No. 205-X74C. J. A. Swartout. Sept. 14, 1944. Decl. Jan. 18, 1956. 16p. (A-2878). $3.30(ph OTS); $2.40(mf OTS).

An empirical equation for the solubility of $\alpha$-$BiPO_4$ in 1 to 10N $HNO_3$ at 0 to 75°C, has been developed. From this equation a nomograph has been constructed to permit rapid determination of solubilities. A combination of this equation with a relation representing the solubility of $\alpha$-$BiPO_4$ in $HNO_3$ containing $H_3PO_4$ has permitted the construction of nomographs for this system. A similar relationship and therefore the same form of nomograph should theoretically represent the solubility of $\alpha$-$BiPO_4$ in $HNO_3$ containing excess $Bi^{+3}$. However, no experimental data have been obtained for this system. Data from the literature for the solubility of $BiONO_3$ in $HNO_3$ are presented graphically. The necessity for the investigation of the solubility of $BiPO_4$ in a number of binary, tertiary, and multicomponent systems is indicated. (auth)

## NEUTRONS

**5332** AECD-4043
Oak Ridge National Lab., Y-12 Area Tenn.
SUGGESTED CORRECTION TO AGE-DIFFUSION EQUATION AS USED BY THE ANP PHYSICS GROUP. R. R. Coveyou and B. T. Macauley. Nov. 6, 1951. Decl. Jan. 27, 1956. 7p. Contract W-7405-eng-2 . (Y-F10-73). $1.80(ph OTS); $1.80(mf OTS).

**5333** CF-47-1-42
Oak Ridge National Lab., Tenn.
ANALYSIS OF DELAYED NEUTRONS. H. E. Stevens, Jr. and J. W. Simpson. Jan. 28, 1947. Decl. Dec. 5, 1955. 5p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A mathematical analysis of delayed neutrons is given. (B.J.H.)

**5334** CF-54-8-98
Oak Ridge National Lab., Tenn.
AGE MEASUREMENTS IN LiF. J. E. Faulkner. Aug. 31, 1954. Decl. Dec. 16, 1955. 4p. Contract [W-7405-eng-26]. $0.10(OTS).

The relation of neutron flux reductions due to capture in $Li^6$ to age measurements in LiF is discussed. (B.J.H.)

**5335** LA-66
[Los Alamos Scientific Lab., N. Mex.]
THE ENERGIES OF THE NEUTRONS FROM POLONIUM ALPHAS ON BORON. I. H. Perlman, H. T. Richards, and J. H. Williams. Feb. 17, 1944. Decl. Dec. 16, 1955. 11p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40 (mf OTS).

The energy spectrum of the neutrons emitted when a thick boron target is bombarded by polonium alpha particles has been studied by the photographic emulsion method. From 355 recoil proton tracks a neutron distribution is inferred which shows a broad maximum at about 2.5 Mev and extrapolates to zero at about 6 Mev on the high-energy end. A suggestion is made for producing a mock fission-neutron source, and a brief discussion is included of the photographic vs. ionization-chamber techniques of measuring neutron energies. (auth)

**5336** ORNL-272
Oak Ridge National Lab., Tenn.
APPROXIMATE FORMULAS FOR THE SLOWING DOWN OF NEUTRONS IN MIXTURES OF WATER AND ALUMINUM. F. H. Murray. July 21, 1949. Decl. Jan. 6, 1956. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Analytical methods are applied to the calculation of the flux distribution in mixtures of aluminum and water. Certain approximations lead to comparatively simple procedures for calculating the neutron flux spectrum at various distances from the source; possible errors associated with this system of calculation can be checked by comparison with experiment. Computations were made for pure water, two volumes water to one of aluminum, and equal volumes of water and aluminum, with the aid of a recent formula for the fission spectrum. Excellent agreement was found for the mixtures at large distances; the formula gives an appreciable overestimate for pure water, as expected from the hypothesis of no angular deviation but only energy losses in a collision of a neutron with a hydrogen nucleus. (auth)

## NUCLEAR PHYSICS

**5337** AECD-3893
[Clinton National Lab., Oak Ridge, Tenn.]
PHYSICS DIVISION QUARTERLY REPORT COVERING PERIOD MARCH–APRIL–MAY 1947. L. W. Nordheim. June 19, 1947. Decl. with deletions Jan. 10, 1956. 141p. Contract W-35-058-eng-71. $22.80(ph OTS); $7.20(mf OTS).

The experimental equipment used to measure neutron

decay is discussed. The average $\gamma$ energy per $\beta$ particle from $As^{76}$ was 0.35 Mev. A comparison was made of the photoneutrons from $U^{233}$, $U^{235}$, and $Pu^{239}$ fission products. Neutron scattering measurements in NaH or NaD were made, and the effect of temperature on the results were studied. The stopping of fission fragments in air was studied by counting the delayed neutrons as a function of air pressure. The efficiency of $(CH_2)_n$ films for counting fast neutrons by (n,p) reactions was considered. A counter using stacks of such thin films is described. Data are given on the decay of $Tm^{169*}$. (K.S.)

**5338** MonP-321
[Clinton Labs., Oak Ridge, Tenn.]
SOLUTION OF A TWO DIMENSIONAL NEUTRON DIFFUSION PROBLEM. L. Noderer and G. Goertzel. June 6, 1947. Decl. Jan. 10, 1956. 6p. Contract W-35-058-eng-71. $1.80(ph OTS); $1.80(mf OTS).

The neutron flux distribution for a repeating cell lattice, infinite in the Z direction and consisting of square prisms of material A surrounded by material B, is calculated. (D.E.B.)

**5339** MonP-437
[Clinton Labs., Oak Ridge, Tenn.]
PHYSICS DIVISION. QUARTERLY REPORT, PERIOD COVERED: SEPTEMBER, OCTOBER AND NOVEMBER 1947. Dec. 11, 1947. Decl. Jan. 12, 1956. 70p. Contract W-35-058-eng-71. $13.80(ph OTS); $4.80(mf OTS).

Neutron decay experiments are described in detail. Calculations on Be-reflected reactors were made. Studies on Bi reflectors are described in detail, and results are given in graphical form. It was concluded that Bi is a considerably poorer reflector than Be. Studies were also made on half and half $H_2O$–Be reflectors. Pile oscillator studies are described. Neutron-diffraction studies are summarized. The distribution of In resonance neutrons in graphite is given. Neutron age measurements were made in $H_2O$. Fission fragment ranges are given. Measurements were made on fission neutron angular correlation in $U^{235}$. The safety system for the high flux reactor is described. Instrument development is discussed. Reactor shielding tests are discussed. (B.J.H.)

**5340** NAA-SR-925
North American Aviation, Inc., Downey, Calif.
REACTOR PHYSICS QUARTERLY PROGRESS REPORT [FOR] NOVEMBER, 1953–JANUARY, 1954. R. A. Laubenstein, ed. Mar. 10, 1954. Decl. Dec. 8, 1955. 22p. Contract AT-11-1-Gen-8. $4.80(ph OTS); $2.70 (mf OTS).

A series of thermal neutron diffusion length measurements has been made on nonmultiplying lattices of lead–cadmium alloy rods in $D_2O$. One-inch diameter rods in square lattice spacings of 4.9, 6, 9, and 12 inches were used. Excellent agreement was found between theoretical and experimental values of the diffusion length. The analysis of the diffusion length measurements required a correction for the epithermal neutrons entering the exponential tank. These epithermal neutrons provided a distributed source of thermal neutrons upon slowing down in the lattice. Results of a measurement of the buckling and intracell flux distributions of a natural uranium lattice in borated $D_2O$ are reported. Comparison of these measurements with similar data obtained with clean $D_2O$ indicates that a correction for the absorption of epithermal neutrons is necessary in order to obtain a consistent theoretical analysis. Exponential experiments have been performed using single rods of uranium in the $D_2O$ tank. A discrepancy of about 5 per cent has been observed between the relative neutron multiplications for rods of three different enrichments and the relative multiplications calculated from the known enrichments. It is uncertain whether these discrepancies are caused by inappropriateness of the theory used or by inaccuracies in the enrichment of purity assumed for the uranium. The effect of cadmium box thickness on the absorption of epithermal neutrons by cadmium-covered indium and gold foils has been reinvestigated. For 0.005-inch thick foils in boxes made from 0.020-inch cadmium, correction factors of 1.05 and 1.01 were obtained for indium and gold foils, respectively. An automatic scaler control device has been installed in the counting room. This device automatically turns on and off and resets the scalers at the proper times. The resolution time correction for each scaler is displayed on a calibrated count rate meter during the counting time. The danger coefficient facility on the Water Boiler Neutron Source has been used to compare the natural uranium used in the exponential experiments at North American Aviation, Inc. (NAA) with that used at Chalk River. The tests indicate that the Canadian uranium has a greater impurity content corresponding to about 0.6 parts per million equivalent of boron by weight. This is not sufficient impurity to explain discrepancies in uranium lattice measurements at the two sites. (auth)

**5341** ORNL-1617
Oak Ridge National Lab., Tenn.
STABLE ISOTOPE RESEARCH AND PRODUCTION DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 20, 1953. Feb. 5, 1954. Decl. Jan. 11, 1956. 46p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

The Isotope Analysis Methods Lab. reports on the microwave spectrum of vinyl fluoride, infrared and microwave spectra of formyl fluoride, spectroisotopic assay of Li, hyperfine structure of $U^{233}$ and $U^{235}$, theory of the aperture-limited Fabry-Perot interferometer, and a decay scheme of $Ta^{183}$. The Mass Spectrometer Lab. reports on investigations of ARE fuels and isotopic abundances of Pd. Research and Development of Stable Isotopes reports on the reduction of various metal salts. Stable Isotope Separation Research processed eight elements (Pt, Ru, Nd, Gd, Ir, Sm, K, and La). The Stable Isotope Chemistry, Research, and Production Dept. reports the separation of the rare earths by a liquid-liquid extraction. (B.J.H.)

**5342** UCRL-2539
California. Univ., Berkeley. Radiation Lab.
MONTHLY PROGRESS REPORT NO. 131 [FOR] FEBRUARY 15, 1954 TO MARCH 15, 1954. Apr. 6, 1954. Decl. Jan. 13, 1956. 18p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

An investigation was made of the polarization of neutrons obtained from the bombardment of C by a proton beam of known polarization. The status of other research in experimental physics, theoretical physics, MTA target physics program, accelerator construction and operation, chemistry, and biology and medicine is reported. (B.J.H.)

## NUCLEAR PROPERTIES

**5343** AECD-3894
Oak Ridge National Lab., Tenn.
ANALYSIS OF LID TANK NEUTRON DATA FOR LEAD AND IRON. S. Podgor. Jan. 23, 1951. Decl. with deletions Jan. 5, 1956. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

An analysis of the Lid tank neutron data for Pb–$H_2O$ and Fe–$H_2O$ is made. "Effective" fast neutron cross sections for the metals are obtained. This is based on the "one collision theory" of shielding. Values are 3.4 barns for Pb and 2.0 barns for Fe. These compare very well

with those obtained by Albert and Welton based on other lid tank data and another method of calculation. (auth)

**5344** AECD-4053
Oak Ridge National Lab., [Y-12 Area], Tenn.
VALUES OF RESONANCE INTEGRALS. E. S. Wilson. Apr. 30, 1952. Decl. Jan. 13, 1956. 5p. Contract [W-7405-eng-26]. (Y-F10-101). $1.80(ph OTS); $1.80(mf OTS).

**5345** CP-2269
Columbia Univ., New York.
THE SLOW NEUTRON TRANSMISSION OF Be METAL AS MEASURED BY A NEUTRON BEAM SPECTROMETER IN THE ENERGY REGION 0.004 EV. TO 50 EV. L. J. Rainwater and W. W. Havens, Jr. Oct. 11, 1944. Decl. Dec. 14, 1955. 18p. (A-2135). $3.30(ph OTS); $2.40(mf OTS).

Slow neutron transmission measurements as a function of the time of flight of the incident neutron were made for three different thicknesses of Be. The energy region from 0.004 ev to 50 ev was investigated using the Columbia neutron beam spectrometer system. Particular emphasis was placed on the very low energy region (from 0.004 ev to 0.2 ev or from 0.6 to 5 A) where pronounced crystal interference effects were observed. The effective slow neutron cross section (in units of X $10^{-24}$ $cm^2$/atom) for several different energy values were: 6.1 at 0.2 A, 3.5 at 1.5 A, 2.3 at 2.5 A and 0.6 at 4.6 A. The positions of the discontinuities in the cross section agree fairly well with the values obtained from the x-ray measurements. (auth)

**5346** ORNL-34
Oak Ridge National Lab., Tenn.
DECAY CURVES FOR 23 FISSION PRODUCTS. G. H. Hanson. Apr. 23, 1948. Decl. Jan. 13, 1956. 28p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A series of decay curves is presented whereby the total $U^{233}$ fission product activity associated with one kilogram of Th irradiated for various periods of time at various thermal neutron fluxes can be obtained. Fission product activities with thermal neutron fluxes less than $10^{12}$ can be obtained by using the chart for a flux of $10^{12}$ and the relationship, $\log_{10}$(total $U^{233}$ fission product activity) = 2 × $\log_{10}$(thermal neutron flux) + B. The constant, B, is determined when the corresponding value with a flux of $10^{12}$ is introduced into the equation. Tabulations from which growth curves for $U^{233}$ fission products, $U^{233}$, $Pa^{233}$, and $Th^{233}$ can be constructed are included. An analytical expression for the total activity from $U^{233}$ fission products developed by N. M. Dismuke and K. Way is also presented. (auth)

**5347** ORNL-418
Oak Ridge National Lab., Tenn.
COLLECTION OF DATA FOR SHIELDING. F. Friedman and H. Feshbach. Oct. 19, 1949. Decl. Jan. 11, 1956. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

**5348** UCRL-206
California. Univ., Berkeley. Radiation Lab.
PARAMAGNETIC SUSCEPTIBILITIES AND ELECTRONIC STRUCTURES OF AQUEOUS CATIONS OF ELEMENTS 92 TO 95. Jerome J. Howland and Melvin Calvin. Nov. 12, 1948. Decl. Jan. 12, 1956. 21p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Magnetic susceptibilities per gram atomic weight of elements 92 to 95 in most of their oxidation states were measured on 0.1 ml of solution which was 0.007 to 0.09M in heavy element. The values obtained (all paramagnetic) in cgs units × $10^6$ were: U(IV), 3690; Np(VI), 2060; Np(V), 4120; Np(IV), 4000; Pu(IV), 1610; Pu(III), 370; Am(III), 720. The results could be interpreted only on the basis of electronic configurations $5f^n$, even though susceptibilities were generally lower than the theoretical values and lower than experimental values for corresponding lanthanide cations. The lower values should be expected as a result of the Stark effect produced by fields of anions and of water dipoles. Failure of the Russell-Saunders approximation to the coupling between electrons may account for some of the error in the theoretical calculations. Wider multiplet splitting in the actinides accounts for the fact that the susceptibilities of Pu(III) and Am(III) are many-fold lower than those of Sm(III) and Eu(III) respectively. (auth)

Refer also to abstract 5316.

## NUCLEAR REACTORS

**5349** A-4243
General Electric Co., Schenectady, N. Y.
ANALYSIS OF ERRORS IN METHOD FOR COMPUTING CRITICAL MASSES OF INTERMEDIATE PILES WHICH ARISE FROM A SPATIALLY DISCONTINUOUS SOURCE DISTRIBUTION AND OTHER FACTORS. Lewi Tonks. [nd]. Decl. Dec. 3, 1955. 19p. (GE-LT-2). $4.80(ph OTS); $2.70(mf OTS).

**5350** AECD-3902
Ferguson (H.K.) Co., New York.
FLASH COOLING OF PRIMARY COOLING WATER. J. J. Byrnes and K. Diehl. Jan. 7, 1952. Decl. Dec. 7, 1955. 11p. (HKF-1492D-107). $3.30(ph OTS); $2.40(mf OTS).

An evaluation is made of the practicality of removing heat from reactor cooling water by means of a flash cooler. The economics of such a system are compared with those of conventional heat exchange systems. Designs for the system, based on the design of the MTR units, are given. It is concluded that the flash cooler is competitive with conventional heat exchange from the standpoint of economics, and that continuous removal of gases formed by dissociation is obtained as an inherent feature of the system. (B.J.H.)

**5351** AECD-3922
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TECHNICAL QUARTERLY REPORT [FOR] SECOND QUARTER [OF] 1953. J. R. Huffman. Aug. 4, 1953. Decl. with deletions Jan. 6, 1956. 20p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Studies on the operation of the MTR have been concerned with the choice of the best operating cycle. A serviceable group of weighting factors for fuel and poison in the various lattice positions has been developed. The program on flux monitoring and mapping has been concerned with intercomparisons of flux measuring techniques in order to eliminate apparent discrepancies in the various methods. A method for the nondestructive assay of fuel assemblies was developed. Studies have been continued on process water activity and damage to reactor components, fuel assemblies, and Th. (J.E.D.)

**5352** AECD-3958
General Electric Co. Aircraft Nuclear Propulsion Project, Cincinnati.
REACTIVITY OF THE CRITICAL EXPERIMENT AS A FUNCTION OF GAP WIDTH. James A. McLennan. Aug. 8, 1952. Decl. Dec. 29, 1955. 15p. (DC-52-28-52). $3.30(ph OTS); $2.40(mf OTS).

The split reactor of the Aircraft Reactor Critical Experiment is analysed, using a single-energy group-diffusion approximation. A further approximation is introduced in that the two halves of the reactor are treated as parallele-pipeds rather than half-cylinders. The reactivity of

the reactor is obtained as a function of the separation of the two halves, both for the "standard" U concentration and for various greater concentrations. (auth)

**5353** AECD-3980
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PRELIMINARY PROCESS DESIGN REPORT. Technical Division Quarterly Report. C. B. Graham, C. H. Secoy, I. Spiewak, E. H. Taylor, A. M. Weinberg, C. E. Winters, and J. L. English. Dec. 28, 1949. Decl. with deletions Dec. 5, 1955. 90p. Contract W-7405-eng-26. $13.80(ph OTS); $4.80(mf OTS).

A small (pilot model) reactor for the purpose of obtaining data which could be used for the design of various large scale types of homogeneous reactors has been considered. A general description of the pilot-model homogeneous power reactor, a description of the reactor system, a discussion of major problems and a development program, and an appendix of further data and information are presented. (G.Y.)

**5354** AECD-4011
North American Aviation, Inc., [Downey, Calif.]
REMARKS ON REACTIVITY CONTROL IN LIGHT WATER MODERATED REACTORS. R. L. Stoker. May 28, 1953. Decl. Jan. 11, 1956. 3p. Contract [AT-11-1-gen-8]. (NAA-SR-Memo-706). $1.80(ph OTS); $1.80 (mf OTS).

**5355** AECD-4012
North American Aviation, Inc., [Downey, Calif.]
OPTIMUM WATER VELOCITY FOR THE CONVERTER REACTOR. W. C. Cooley. June 18, 1952. Decl. Jan. 11, 1956. 10p. Contract [AT-11-gen-8]. (NAA-SR-Memo-366). $1.80(ph OTS); $1.80(mf OTS).

Two cases are considered. In Case I, the reactor water velocity is optimized to obtain a minimum annual cost (including amortization and operating costs) for the cooling system alone. The optimum velocity for a 310-Mw reactor is calculated to be ~25 feet per second, compared to the present design value of 30 feet per second. In Case II, the velocity which will give the minimum cost of product under the assumptions of varying power and production rate is found to be in the range from ~25 to ~40 ft sec, depending on assumptions with respect to the variation of total investment in the reactor complex with design production capacity. (auth)

**5356** AECD-4014
North American Aviation, Inc., Downey, Calif.
EFFECT OF EPITHERMAL CAPTURE ON $\eta$. E. R. Cohen. May 28, 1952. Decl. Jan. 13, 1956. 10p. (NAA-SR-Memo-349). $1.80(ph OTS); $1.80(mf OTS).

It is noted that some neutrons can be captured in a reactor lattice before they are completely slowed down, thus increasing the multiplication factor of the lattice. A quantitative investigation is given of this effect. (B.J.H.)

**5357** AECD-4021
North American Aviation, Inc., [Downey, Calif.]
DEPENDENCE OF THERMAL UTILIZATION AND RESONANCE ESCAPE PROBABILITY UPON FUEL ELEMENT DENSITY IN $D_2O$ COOLED AND MODERATED SYSTEMS. J. E. Garvey. Apr. 23, 1952. Decl. Jan. 13, 1956. 13p. Contract [AT-11-1-gen-8]. (NAA-SR-Memo-305). $3.30(ph OTS); $2.40(mf OTS).

The effect of variation in fuel element density upon (f,p) in a $D_2O$ cooled and moderated lattice of cylindrical fuel elements is investigated. The CP-3 lattice is chosen as a reference. The effect of a source term in the fuel element is considered. f,p are calculated as functions of $\alpha$, the ratio of the modified fuel element density to the original (fuel only) density. Curves showing $f(\alpha)$, $p(\alpha)$ are included. It is concluded that a 1 per cent decrease in the product. $f(d)$, $p(\alpha)$ is not suffered until $\alpha \simeq 0.3$. A 5 per cent decrease in k is estimated at $\alpha = 0.4$. The necessity of introducing the fuel element source term into the calculation after $\alpha$ has decreased to about 0.6 is brought out. (auth)

**5358** AECD-4025
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR PHYSICS, SECTION II [OF] PROGRESS REPORT NO. 39 [FOR] OCTOBER 1-31, 1949. Nov. 30, 1949. Decl. with deletions Jan. 10, 1956. 36p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00(mf OTS).

Theoretical work in calculating adjoint functions and fluxes at Mn, Au, and In resonances in the KAPL Intermediate Power Breeder Critical Experiments (SAPL) is summarized. Values for Pu alpha have been confirmed. Alpha experiments are being continued in the SAPL preliminary pile assembly; accepted values are given for $\nu$, danger coefficients, and $\alpha$. Measurements of the Doppler effect in $U^{235}$ in the intermediate spectrum are underway. An optical fringe method for determination of $O_2$ in He is described briefly. Tests are being conducted on friction and leakage of "O" ring seals. Data on creep of Na on inside walls of cylinders having various finishes are tabulated. (G.Y.)

**5359** AECD-4032
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
PRODUCTION OF $Xe^{131}$, $Xe^{135}$, $Kr^{85m}$, AND $Kr^{85}$ FROM PLATED-OUT $U^{235}$ IN THE MTR CORE. Adrian V. Grimaud. Jan. 14, 1955. Decl. Jan. 12, 1956. 16p. Contract AT(10-1)-205. (PPC-15). $3.30(ph OTS); $2.40(mf OTS).

During the period following October 7, 1954 the MTR developed high process water radioactivity. Indications suggest that this activity results from the fissioning of $U^{235}$ which has plated out upon reactor components with the subsequent release of fission products directly into the process water system during operation. Equations are presented from which the instantaneous rate of release (during operation) of $Xe^{131}$, $Xe^{135}$, $Kr^{85m}$, and $Kr^{85}$ in curies/sec. from the process water system can be obtained. Curves are given showing the approximate rate of release of these gases during runs 43B to 43L inclusive. (auth)

**5360** AECD-4034
North American Aviation, Inc., [Downey, Calif.]
FLUX DISTRIBUTION—CONVERTER REACTOR. E. R. Cohen. Jan. 2, 1952. Decl. Jan. 13, 1956. 13p. (NAA-SR-Memo-173). $3.30(ph OTS); $2.40(mf OTS).

A simplified calculation has been carried out in order to gain some insight into the flux distribution, peak to average power density, efficiency of a catching blanket and the effect of a reflector in the proposed converter reactor. Results are presented for $H_2O$, graphite and Be reflectors combined with the MTR-type core and blanket elements. Calculations were made using numbers which are not necessarily correct, but which should be adequate for present purposes. The model used was a spherical core, radius 85 cm, surrounded either by a 15 cm Th blanket and then a 20 cm reflector, or by a 15 cm reflector and outside this a 20 cm Th blanket. The volume of the core is that of a cylinder 4 ft, 10 in. high and 4 ft, 10 in. diameter. (auth)

**5361** AECD-4035
North American Aviation, Inc., [Downey, Calif.]
EXPRESSIONS FOR CONVERSION RATIO IN A Th–$U^{233}$ CONVERTER. E. R. Cohen and A. Benton. Dec. 19, 1951. Decl. Jan. 13, 1956. 6p. Contract [AT-11-1-GEN-8].

(NAA-SR-Memo-165). $1.80(ph OTS); $1.80(mf OTS).

An attempt is made to write down in a consistent manner some expressions for a conversion ratio so that a comparison can be made with regard to a uniformly loaded core versus a flattened zone surrounded by an unloaded region. The discussion will be limited to the type of loading that is at present being considered for the reactor—a checkerboard array of MTR fuel elements and feed elements; the unloaded reactor will consist of fuel elements only. (auth)

**5362** AECD-4041

North American Aviation, Inc., Downey, Calif.

POISON TRANSIENT AFTER POWER CUTBACK AND ITS EFFECT ON REACTIVITY. C. Roderick. May 14, 1952. Decl. Jan. 16, 1956. 12p. Contract [AT-11-1-GEN-8]. (NAA-SR-Memo-314). $3.30(ph OTS); $2.40(mf OTS).

The $Xe^{135}$ and $Sm^{149}$ transients due to rapid power outbacks and the effects of these transients on reactivity are studied and presented in a general manner, so as to be applicable to the UPR for U- and Pu-producing cores. (auth)

**5363** AECD-4052

North American Aviation, Inc., [Downey, Calif.]

FURTHER STUDIES ON CONTROL OF THE CONVERTER REACTOR. L. B. Robinson. May 12, 1952. Decl. Jan. 12, 1956. 17p. Contract [AT-11-1-GEN-8]. (NAA-SR-Memo-318). $3.30(ph OTS); $2.40(mf OTS).

The number of control rods in the UPR as a function of the amount of reactivity to be controlled is calculated. Numerical solutions are given for a typical example and are readily obtainable for other cases. (auth)

**5364** AECD-4060

Oak Ridge National Lab., Y-12 Area, Tenn.

NUMERICAL TECHNIQUE FOR CRITICALITY CALCULATIONS ON HYDROGEN MODERATED REACTORS. J. W. Webster. Aug. 20, 1951. Decl. Jan. 13, 1956. 11p. Contract W-7405-eng-26. (Y-F10-66). $3.30(ph OTS); $2.40 (mf OTS).

**5365** AECD-4072

North American Aviation, Inc., Downey, Calif.

INFLUENCE OF ABSORPTION ON THE EFFECTIVE VALUE OF ETA. E. Richard Cohen. Jan. 22, 1953. Decl. Jan. 12, 1956. 12p. Contract AT-11-1-GEN-8. (NAA-SR-Memo-578). $3.30(ph OTS); $2.40(mf OTS).

Calculations are carried out for determining the effect of epithermal capture on $\eta$ values used in lattice calculations. (D.E.B.)

**5366** AECD-4074

North American Aviation, Inc., Downey, Calif.

THE VARIATION IN MAXIMUM POWER DENSITY AND MAXIMUM HEAT FLUX OF THE CORE AND BLANKET THORIUM PLATES IN THE CONVERTER REACTOR WITH IRRADIATION TIME. H. L. Sletten. June 23, 1952. Decl. Jan. 12, 1956. 11p. Contract [AT-11-1-GEN-8]. (NAA-SR-Memo-368). $3.30(ph OTS); $2.40(mf OTS).

The time variation of the maximum heat flux from the Th plates of the core and blanket of the converter reactor is determined by estimating the various factors which contribute to heat generation within the Th. It is seen that the fissioning of $U^{233}$ in the Th is the only significant factor causing the transient. The steady state component of heat flux is $0.109 \times 10^6$ Btu/hr-ft$^2$ in the core and $0.0304 \times 10^6$ Btu/hr-ft$^2$ in the blanket. The maximum heat flux from the core Th plates is increased to $0.319 \times 10^6$ Btu/hr-ft$^2$ after 100 days of irradiation. After 365 days of irradiation, the maximum heat flux in the blanket is $0.0794 \times 10^6$ Btu/hr-ft$^2$. These irradiation times correspond to about 0.3% burn-up of Th. (auth)

**5367** ANL-4937

Argonne National Lab., Lemont, Ill.

LAYER FORMATION BY INTERDIFFUSION BETWEEN SOME REACTOR CONSTRUCTION METALS. J. Howard Kittel. June 17, 1949. Decl. Dec. 9, 1955. 29p. Contract W-31-109-eng-38. $0.25(OTS).

In order to study the diffusion reaction characteristics of the metals which have been proposed for use in the EBR, a number of experiments have been completed in which many combinations of the proposed metals have been given diffusion treatments at various elevated temperatures for extended lengths of time. The metals being studied are Be, Nb, Fe, Mo, Ni, Ta, Ti, U, W, Zr, and 347 stainless steel. The above metals have all been used in a commercially pure state. The experimental temperatures ranged from 400 to 800°C, and the durations of the diffusion treatments ranged from 6 to 48 days. With the exception of Ti, over 400 diffusion couples representing all possible combinations of the above eleven metals have been made and examined after diffusion anneals. Ti was not on hand during most of the investigation, and at the time of writing it has been tested only against U and 347 stainless steel at 500°C. A series of tests was also made to evaluate the strengths of the bonds formed when interdiffusion of the metals occurred. (auth)

**5368** BNL-126

Brookhaven National Lab., Upton, N. Y.

THE EFFECT OF VARIABLE LOCAL MULTIPLICATION ON THE STATICS OF A REACTOR. J. Chernick. Aug. 15, 1951. Decl. Dec. 29, 1955. 27p. $0.25(OTS).

The eigenvalue problem for a critical reactor with variable local multiplication is solved exactly in certain cases and the results compared with perturbation theory approximations. Both flux-dependent and space-dependent local multiplication are considered. The applications to reactor design problems, particularly to equilibrium xenon and temperature effects, are pointed out. A new method of calculation of equilibrium xenon poisoning on a statistical weight basis is proposed which is applicable to a wide range of flux levels and flux distributions. (auth)

**5369** BNL-1782

Brookhaven National Lab., Upton, N. Y.

LMFR PROGRESS LETTER FOR FEBRUARY 1954. F. T. Miles. Mar. 10, 1954. Decl. Dec. 12, 1955. 3p. $1.80 (ph OTS); $1.80(mf OTS).

Particle growth studies of $Th_3Bi_5$ in Bi and Pb–Bi eutectic are summarized. The status of various LMFR studies is presented. (L.M.T.)

**5370** BNL-2398

[Brookhaven National Lab., Upton, N. Y.]

ANODIZED COATING. O. F. Kammerer. June 23, 1949. Decl. Dec. 14, 1955. 2p. Contract [AT-30-2-gen-16]. $1.80(ph OTS); $1.80(mf OTS).

Measurements were made of the thickness of the anodized coating on fin tubing (fuel rod can). (B.J.H.)

**5371** CE-288

[Clinton Labs., Oak Ridge, Tenn.]

QUARTER-POINT GAS INTRODUCTION SCHEME FOR HELIUM COOLED PLANT. M. C. Leverett. Oct. 6, 1942. Decl. Dec. 13, 1955. 9p. (A-308). $1.80(ph OTS); $1.80 (mf OTS).

The engineering problems involved in a proposal to alter the helium cooled pile design so as to introduce the cold helium at the top, bottom and middle of the pile, and to remove hot helium from quarter-points of the pile are discussed. The main reason for this procedure is that it might give a lower average temperature of the pile than the straight series flow. The conclusion of the study is that the

temperature would not be lowered substantially, and that the only other considerable advantage is the reduced pressure drop. This can be obtained with less complexity by parallel flow and the quarter-point scheme is therefore not recommended. (auth)

**5372** CE-481
[Chicago. Univ. Metallurgical Lab.]
INVESTIGATION OF PRESSURE DROPS CAUSED BY URANIUM PLATES IN THE HELIUM COOLED PLANT. M. M. David, Jr. Feb. 22, 1943. Decl. Jan. 18, 1956. 23p. Contract [W-7401-eng-37]. (A-470). $4.80(ph OTS); $2.70(mf OTS).

Full scale wooden replicas were used in an experimental study of the pressure drop caused by the flat lugged plate assemblies proposed for one design of the helium cooled power plant. Air at about 1 atm. was used instead of the helium which would be at 7 atm. in the plant, since the densities are the same within a factor of two or less. The air velocities ranged up to 250 ft/sec at about 120 ft/sec, which approximates a design condition, the pressure drop per element ranged from 0.077 psi to 0.30 psi depending on the plate thickness and plate edge treatment. Three plate thickness, $\frac{3}{16}$ in., $\frac{1}{4}$ in. and $\frac{3}{8}$ in. were tested, and various degrees of tapering of the edges were tried. The best results came from tapering both the leading and trailing edges to a 30° included angle (the smallest tried). This treatment reduced entrance-exit losses from about 2.0 velocity heads to about 0.5 velocity heads per element. Friction losses (calculated) ran from about 0.17 to 0.31 velocity heads. Tapering of the edges of the plates is evidently essential if this design is to be used. (auth)

**5373** CF-49-11-273
Oak Ridge National Lab., Tenn.
MTR REPORT ON REACTOR STRUCTURAL STEEL. W. R. Gall. Nov. 29, 1949. Decl. Dec. 15, 1955. 8p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

This is one of a series of design reports on the Materials Testing Reactor written to transmit necessary information to the design contractor. This report outlines the requirements of a structural steel framework within the concrete shield for the purpose of supporting and maintaining alignment of the reactor tank. The design of this structure as shown on ORNL drawings is also given. This proposed design consists of four columns, a horizontal frame of beams at the sub-pile room ceiling, a set of brackets attached to tank section A and four angle brackets to support the thermal shield. The following components are supported or resisted by the steel structure: the reactor tank and its contents; the thermal shield and graphite; concrete above the sub-pile room and two feet of concrete above the thermal shield; vertical forces due to internal water pressure in the tank. (auth)

**5374** CF-49-12-50
Oak Ridge National Lab., Tenn.
DESIGN OF SYPHON VENT LINE. J. A. Lane. Dec. 14, 1949. Decl. Dec. 19, 1955. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The minimum size vent line required to prevent the complete syphon of water from the reactor tank in case of breakdown of the exit water lines beyond the exit water main loop is determined. Included are calculations of the water velocity in the reactor tank, the pressure drop in the vent line, the effect of constriction by air in the loop, calculations for a 2-in. vent line, and water flow through the vent line. (B.J.H.)

**5375** CF-50-2-19
Oak Ridge National Lab., Tenn.
SUPPLEMENT TO PROPOSAL FOR BULK SHIELD TESTING FACILITY. Feb. 6, 1950. Decl. Nov. 29, 1955. 26p. Contract [W-7405-eng-26]. $16.80(ph OTS); $5.70(mf OTS).

The modifications in design which were made since the initial proposal are listed. Also included are general discussions of the normal operation plan, safety and control circuits, shielding, catastrophic behavior, disposal of $H_2O$ in the pool, and gaseous fission products. Drawings of the facility are included. (B.J.H.)

**5376** CF-51-11-92
Oak Ridge National Lab., Tenn.
PILE SIMULATOR STUDY OF NEUTRON FLUX IN HRE FOLLOWING A DECREASE IN COOLANT FLOW. S. Hanauer. Nov. 12, 1951. Decl. Dec. 21, 1955. 9p. Contract [W-7405-eng-26]. $0.15(OTS).

**5377** CF-53-2-134
Oak Ridge National Lab., Tenn.
CONVERSION IN A TWO-REGION REACTOR. M. Tobias, P. N. Haubenreich, and R. E. Aven. Feb. 16, 1953. Decl. Dec. 20, 1955. 23p. Contract [W-7405-eng-26]. $0.25(OTS).

Calculations were performed by two group methods to determine the critical concentration, neutron balance and conversion ratio in a two-region reactor. The reactor had the following geometry: a 4-ft.-diam. spherical core of uranyl sulfate dissolved in heavy water is contained in a shell of stainless steel surrounded by a two-foot-thick spherical blanket containing Th and heavy water. Two stainless steel core shells, $\frac{1}{8}$- and $\frac{1}{4}$-inch thick were considered. For each core shell, three concentrations of Th were supposed: 1000 g Th per liter (as a slurry of $ThO_2$), 4218 grams Th per liter (as pellets of thorium oxide), and 7000 grams Th per liter (as spheres of Th metal). For calculation purposes the Th distribution was considered homogeneous in all cases. Further, it was assumed that the reactor was free of poisons and that no multiplication occurred in the blanket. Thus, the only materials considered present were uranyl sulfate, heavy water, stainless steel, and Th (as oxide or metal). A complete tabulation of results is given. (auth)

**5378** CF-53-10-73
Oak Ridge National Lab., Tenn.
EXPERIMENTAL PROGRAM FOR HRE AT HIGH POWER. PART II: KINETIC EXPERIMENTS. V. K. Paré and S. Visner. Oct. 1, 1953. Decl. Dec. 7, 1955. 16p. Contract [W-7405-eng-26]. $0.20(OTS).

**5379** CF-54-7-95
Oak Ridge National Lab., Tenn.
ORR SHIELDING STUDIES. I. BASIC DESIGN INFORMATION. N. F. Lansing. Aug. 9, 1954. Decl. Dec. 15, 1955. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Basic design criteria which will be used in shielding studies on the ORNL Research Reactor are presented. These criteria include: reactor power level; radiation tolerance; $\gamma$-ray absorption coefficients and relaxation lengths; build-up factor; radiation intensities; permissible temperature differences in concrete; and thermal and mechanical properties of materials. (C.W.H.)

**5380** CF-54-8-179
Oak Ridge National Lab., Tenn.
CERTAIN NUCLEAR DATA AND PHYSICAL PROPERTIES TO BE USED IN THE STUDY OF THORIUM BREEDERS. M. Tobias. Aug. 26, 1954. Decl. Dec. 15, 1955. 7p. Contract [W-7405-eng-26]. $0.15(OTS).

Those nuclear data and physical properties of U isotopes, uranyl sulfate, $D_2O$, thorium oxide, and Zr which will be used in the study of Th breeders are listed. (B.J.H.)

**5381** CP-381
[Chicago. Univ. Metallurgical Lab.]
POISONING AND PRODUCTION IN A POWER PLANT. J. Ashkin, R. F. Christy, and B. T. Feld. Dec. 15, 1942. Decl. Jan. 18, 1956. 9p. Contract [W-7401-eng-37]. (A-416). $1.80(ph OTS); $1.80(mf OTS).

The yield of $Pu^{239}$, the efficiency of production of $Pu^{239}$, and poisoning in a power plant are discussed. Only the crudest of estimates of the poisoning are possible: these indicate that production will probably not be hampered by poisoning. In this case the yield of $Pu^{239}$ could be as high as 3 kg/ton but only about 2 kg/ton is compatible with a fairly high efficiency. This average efficiency is of order 1kg $Pu^{239}$/ $1.5 \times 10^6$ kev day. In the case that production is stopped by poisoning, smaller yields, proportional to the tolerable loss in k, are obtained. In this case the yield will be improved by a factor of 2 or 3 if only the most poisoned parts are extracted and replaced by new uranium. (auth)

**5382** CP-2143
Chicago. Univ. Metallurgical Lab.
FLEXIBILITY OF A TUBE IN WHICH SLUGS SLIDE. G. Young. Sept. 13, 1944. Decl. Jan. 18, 1956. 11p. $3.30 (ph OTS); $2.40(mf OTS).

An approximate calculation is made of the variation of the flexibility of a long cartridge with the length of the slug used, assuming that the jacket slides without fraction. (B.J.H.)

**5383** CP-2824
[Clinton Labs., Oak Ridge, Tenn.]
PHYSICS SECTION MONTHLY REPORT FOR PERIOD ENDING MAY 31, 1945. Decl. Dec. 15, 1955. 38p. Contract W-7405-eng-39. $6.30(ph OTS); $3.00(mf OTS).

A generalization of the weight formula for calculating reactivity changes in composite piles due to small perturbations is derived which permits the evaluation of pile periods for all possible perturbations, including changes in reflector effectivity. Control rod theory is extended to the case of two-group and two-region problems required for enriched pile studies. The two-region problem (pile and reflector) is treated by the one-group theory and the one-region problem (bare pile) by the two-group theory. The remainder of the report consists of very brief summaries of experiments on water lattices, criticality, and neutron cross sections and diffraction. (G.Y.)

**5384** IDO-16017
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
REACTIVITY CHANGED DUE TO BUILDUP OF $Li^6$ IN THE MTR REFLECTOR. H. L. McMurry and J. W. Webster. June 13, 1952. Decl. Jan. 6, 1956. 13p. Contract [AT(10-1)-205]. $3.30(ph OTS); $2.40(mf OTS).

The effect on the operational characteristics of the MTR of the $Li^6$ poison produced by the fast neutron reaction $Be(n,\alpha)He^6 \rightarrow Li^6 + \beta$ has been investigated using the adjoint perturbation and group methods. The Li builds up to substantial equilibrium in about 2 months at 30 Mw, at which time it reduces the reactivity by 0.56%. At 30 Mw, the reactivity $\Delta k_\infty/k_\infty$ changes by 0.0085% per day at startup due to $Li^6$ buildup. If the Be adjacent to the lattice is interchanged with that one row out (5 pieces can be interchanged) after 240 Mwd of operation, the change in $\Delta k_\infty/k_\infty$ is 0.002%. (auth)

**5385** M-3753
[Clinton Labs., Oak Ridge, Tenn.]
FAST AND "MIXED" PILES. PILE TECHNOLOGY LECTURE 24. J. R. Menke. [nd]. Decl. Jan. 10, 1956. 16p. Charge $3.30(ph OTS); $2.40(mf OTS).

The basic characteristics of fast, U-diluted fast, and composite fast reactors are briefly considered. The operation of these reactors is compared. Equations for the excellence, E, of a reactor are included. (B.J.H.)

**5386** M-3754
Clinton Labs., Oak Ridge, Tenn.
PILE TECHNOLOGY. BREEDER BLANKET PROBLEMS. LECTURE 20. R. W. Stoughton. 194? Decl. Jan. 10, 1956. 14p. $3.30(ph OTS); $2.40(mf OTS).

The general aspects of production, breeder, and power reactors are briefly discussed, including the relationship between these three functions. Blanket processing losses are discussed and calculated values are tabulated. Consideration is also given to the effect of processing time schedules and Th distribution on breeding efficiency. Suggestions are made as to the form and processing of the blanket. (B.J.H.)

**5387** M-3856
[Clinton Labs., Oak Ridge, Tenn.]
PILE TECHNOLOGY, LECTURES 35 AND 36: THE CLINTON HIGH FLUX PILE. M. C. Leverett. [194?]. Dec. 5, 1955. 15p. $3.30(ph OTS); $2.40(mf OTS).

The discussion briefly covers reactor characteristics, design, technology, and problems associated with the proposed Clinton High Flux Pile (LITR). (T.W.S.)

**5388** M-3975
[Clinton Labs., Oak Ridge, Tenn.]
PILE TECHNOLOGY, LECTURES 37 AND 38. C. R. McCullough—P. N. Ross, ed. [194?]. Decl. Dec. 5, 1955. 61p. $10.80(ph OTS); $3.90(mf OTS).

The need of a power pile to demonstrate that nuclear energy could be utilized in this manner prompted the design of a He cooled, Be moderated, enriched U, gas turbine plant. The design output of this plant is 3 Mw. Reactor and generator systems are discussed. (D.E.B.)

**5389** M-4423
Massachusetts Inst. of Tech., Cambridge. Servomechanisms Lab.
DESIGN OF REGULATING ROD-POSITION TRANSMITTER. R. A. Bittenbender. June 11, 1948. Decl. Jan. 10, 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

**5390** MonC-53
[Clinton Labs., Oak Ridge, Tenn.]
PRODUCTION OF "LIGHT" ISOTOPES IN A HOMOGENEOUS PILE. J. Halperin and D. E. Koshland, Jr. Jan. 24, 1946. Decl. Jan. 12, 1956. 16p. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

Calculations were made on the production of "light" isotopes in a homogeneous pile and their possible poisoning effects. It appears to be improbable that a large poisoning loss will occur as a result of the products of nuclear reactions on the "light ' isotopes in the pile. The physical constants of some of the isotopes produced, however, require further investigation in order to be assured of their negligibility. The amounts of several isotopes of general research interest which will be produced in relatively large quantities have been calculated. (auth)

**5391** MonN-157
Clinton Labs., Oak Ridge, Tenn.
AIR FLOW AND HEAT REMOVAL IN THE CLINTON PILE. M. C. Leverett. [194?]. Decl. Jan. 16, 1956. 22p. Contract W-35-058-eng-71. $4.80(ph OTS); $2.70 (mf OTS).

The reactor cooling system is described, and complete data are given on pressure drops in the flow system, pressure drops through the pile proper, air flow measurements, and air leakage into the reactor. Discussions are also given on heat transfer from slugs to air and from

slugs to graphite, on calculations of maximum slug temperatures, and on reactor heat flow. (B.J.H.)

**5392** MonN-262
[Clinton Labs., Oak Ridge, Tenn.]
PROCESS DESIGN INFORMATION 1000 PROJECT. I. GENERAL AND 1100 AREA. M. C. Leverett and J. R. Huffman. Mar. 4, 1947. Decl. Jan. 11, 1956. 19p. Contract W-35-058-eng-71. Charge $12.30(ph OTS); $4.50(mf OTS).

The preliminary design is given for a 30-Mw, high flux, enriched $U^{235}$ reactor. The fuel element will be made of U–Al alloy plates clad with Al. $H_2O$ moderation and Be reflection will be employed. Sufficient drawings on the site plan and pile building are included to permit engineering design to commence. (D.E.B.)

**5393** MonN-299
Clinton Labs., Oak Ridge, Tenn.
HEAT TRANSFER IN GAS-COOLED PILES. A. Amorosi. May 29, 1947. Decl. Jan 11, 1956. 105p. Contract W-35-058-eng-71. $18.30(ph OTS); $6.00(mf OTS).

**5394** MonP-60
[Clinton Labs., Oak Ridge, Tenn.]
OPERATING CHARACTERISTICS OF A CHAIN-REACTING PILE. Final Report — Problem Assignment No. 103-X37P. L. B. Borst and A. J. Ulrich. May 8, 1946. Decl. Jan. 12, 1956. 22p. Contract W-7405-eng-39. $4.80(ph OTS); $2.70(mf OTS).

Operating characteristics of the ORNL Graphite Reactor were studied, and the best values of the characteristics are tabulated. (B.J.H.)

**5395** MonP-152
[Clinton Labs., Oak Ridge, Tenn.]
VARIATIONAL METHOD FOR CALCULATING PILE PROPERTIES. H. C. Schweinler. Aug. 8, 1946. Decl. Jan. 12, 1956. 6p. Contract W-35-058-eng-71. $1.80 (ph OTS); $1.80(mf OTS).

Variations of the perturbation theory are developed for application to pile burnup calculations. (D.E.B.)

**5396** MonP-198
[Clinton Labs., Oak Ridge, Tenn.]
CRITICAL SIZE AND BREEDING GAIN OF RESONANCE PILES. F. L. Friedman and M. L. Goldberger. Nov. 1, 1946. Decl. Jan. 13, 1956. 28p. Contract [W-7405-eng-39]. $4.80(ph OTS); $2.70(mf OTS).

Equations are developed for critical size and breeding gain calculations on the basis of the theory developed by Friedman and Monk. (B.J.H.)

**5397** MonP-226
[Clinton Labs., Oak Ridge, Tenn.]
A PILE WITH SPACE UNIFORM ACTIVITY. G. Goertzel. Mar. 25, 1947. Decl. Jan. 11, 1956. 10p. Contract W-7405-eng-39. $3.30(ph OTS); $2.40(mf OTS).

Parameters are derived for a pile-breeding arrangement consisting of a spherical core of $U^{233}$, a $D_2O$ moderator, and a Th blanket. (D.E.B.)

**5398** MonP-305
[Clinton Labs., Oak Ridge, Tenn.]
THE PERCOLATOR COOLING SYSTEM FOR PILES. G. Young. May 19, 1947. Decl. Jan. 10, 1956. 5p. Contract W-35-058-eng-71. Charge $1.80(ph OTS); $1.80(mf OTS).

A qualitative description is given of the Douglas "percolator" cooling system for piles, and of how it is related to the Szilard "double stream" system. (auth)

**5399** MonP-402
[Clinton Labs., Oak Ridge, Tenn.]
CRITICAL MASS AND NEUTRON DISTRIBUTION CALCULATIONS FOR THE $H_2O$ MODERATED REACTOR WITH $D_2O$, $H_2O$, AND BE REFLECTORS. E. Greuling and B. Spinrad. Oct. 29, 1947. Decl. Jan. 11, 1956. 16p. Contract W-35-058-eng-71. $3.30(ph OTS); $2.40(mf OTS).

Theoretical critical mass calculations for five experimental piles are described and experimentally checked. Agreement within 5 to 10% was obtained for the calculated and experimental values, the calculated values tending to be higher. (D.E.B.)

**5400** MonP-427
[Clinton Labs., Oak Ridge, Tenn.]
STABILIZATION OF A FLUID PILE AGAINST EXPANSION. G. Young. Nov. 5, 1947. Decl. Jan. 5, 1956. 7p. Contract W-35-058-eng-71. $1.80(ph OTS); $1.80(mf OTS).

Data are presented from which it was concluded that a tank shape can be chosen so that the reactivity of a fluid pile of fixed mass is not affected by a small uniform density change in the fluid. (auth)

**5401** N-1668b
Chicago. Univ. Metallurgical Lab.
SUGGESTIONS FOR A HIGH TEMPERATURE PEBBLE PILE. Farrington Daniels. Oct. 25, 1944. Decl. Jan. 11, 1956. 11p. Contract [W-7401-eng-37]. (MUC-FD-8). $3.30(ph OTS); $2.40(mf OTS).

The possibility of building a pile of pebbles of uranium carbide and graphite, or equivalent materials, which will operate at 1500 to 2000°C is discussed. The pile is cooled either by circulating helium or boiling bismuth. The cooling gas passes uniformly through the whole cross-section of the pile, which is kept at a steady temperature by convection and radiation. Operation at a high temperature simplifies the cooling operation, opens up the possibility of separating Pu and fission products by vaporization, and leads to greater thermodynamic efficiency in the operation of engines. Experience gained during the recent operation of a gas-heated pebble-bed furnace blowing 2000 cu. ft. of air per minute for nitrogen-fixation, warrants the expectation that there are no serious practical difficulties in the operation of such a pile at 2000°C. (auth)

**5402** N-2300
[Chicago. Univ. Metallurgical Lab.]
EQUALIZATION OF GAS TEMPERATURES ACROSS A HIGH TEMPERATURE OXIDE PILE BY REGULATING COOLANT GAS FLOW IN THE VARIOUS FUEL CHANNELS. L. W. Fromm, Jr. June 6, 1946. Decl. Jan. 27, 1956. 9p. (MUC-CAH-41). $1.80(ph OTS); $1.80 (mf OTS).

It was previously found that the temperature of the exit coolant gases from the fuel channels of a pile will vary across the pile. The problem of equalization of these temperatures is discussed, and several possible methods, all involving regulation of the gas flow in the channels, are described. These methods are: placement of orifices in channels in which gas flow is to be decreased; enlargement of fuel rods in channels in which gas flow is to be decreased; and, division of gas stream and control of sections of the stream so that channels receive predetermined quantities of gas. The required increase in blower horsepower due to increased pressure drop across the pile is given as 23%. (auth)

**5403** NAA-SR-8
North American Aviation, Inc., Los Angeles.
STUDIES ON NUCLEAR REACTORS. 8: ELEMENTARY THEORY OF HOMOGENEOUS EPITHERMAL NUCLEAR REACTORS. C. Starr. Mar. 1, 1948. Decl. Dec. 8, 1955. 14p. (AL-331). $3.30(ph OTS); $2.40(mf OTS).

The general theory of a homogeneous epithermal reactor, without reflector, is developed in a form which permits computation of the critical size of such reactors. It is shown that the familiar forms of the equations for

"thermal" reactors are special cases of the general equation presented here. (auth)

**5404** NAA-SR-9
North American Aviation, Inc., Los Angeles.
STUDIES ON NUCLEAR REACTORS. TEMPERATURE STABILITY OF AN EPITHERMAL REACTOR. M. A. Greenfield and C. Starr. Mar. 1, 1948. Decl. Dec. 8, 1955. 15p. (AL-332). $3.30(ph OTS); $2.40(mf OTS).

The temperature stability of an epithermal nuclear reactor without reflector has been investigated. In such a reactor, temperature stability is found to exist for ratios of macroscopic absorption to scattering cross-section greater than a critical value. This critical ratio is a function of reactor materials. It appears that reactors with a high concentration of fissionable material (i.e., small-size reactors) may have an inherent temperature stability. (auth)

**5405** ORNL-630
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR EXPERIMENT REPORT FOR THE QUARTER ENDING FEBRUARY 28, 1950. C. E. Winters, ed. Apr. 21, 1950. Decl. Jan. 13, 1956. 133p. Contract W-7405-eng-26. $21.30(ph OTS); $6.90(mf OTS).

Solution Stability. Solution-stability experiments indicated that if the uranium sulfate solution is at a temperature of 65°C and at ORNL reactor flux, 1 to 2 excess molar $H_2SO_4$ would be necessary to prevent precipitation of $UO_4$. One experiment at 250°C at the same flux indicated that the excess acid was unnecessary. Gas-formation rates at 65°C and below indicated that 1 molecule of $H_2O$ was decomposed per 50 ev of fission energy and that pressures greater than 10,000 psi were generated in a closed system, indicating that at this temperature, decomposition rates considerably exceed recombination rates and that the application of reasonable pressures to suppress the gas-formation rate is of little practical help. One experiment at 250°C indicated that at a total pressure of 900 psi a pseudoequilibrium was established, indicating presumably that recombination was occurring at a rate approximately equal to the formation rate. This experiment indicated that going to higher pressures and temperatures was in the right direction for the minimization of the bubbling problem. Corrosion. Short-term corrosion experiments at 250°C generally confirmed the selection of zirconium as the material of construction for the homogeneous reactor tank. The experiments also indicated that if too many liberties are taken with solution compositions, corrosion difficulties may be experienced. Stainless steels of a wide variety of composition were generally attacked by uranyl sulfate at 250°C. Addition of extra sulfuric acid greatly accelerated the attack, and, after a sufficiently long period of time in a sealed vessel, reducing conditions were set up with the resulting reduction of the uranyl ion to lower insoluble oxides, principally $U_3O_8$. Additions of oxidizing agents in moderate quantities in the form of $H_2O_2$, $HNO_3$, and $CrO_3$ to the vessels stopped the uranyl reduction and reduced the attack on the stainless steel to tolerable values. Unfortunately, 1 series of experiments with uranyl sulfate plus stabilized $HNO_3$, with or without excess sulfuric acid showed a very serious form of intergranular type of attack on zirconium. A single experiment with $CrO_3$ did not produce this type of attack. Over-all, it continues to appear that there are several conditions under which a uranyl sulfate homogeneous reactor is feasible. Operation is possible at 250°C with uranyl sulfate without excess acid, using a zirconium tank and with the external system constructed of zirconium and perhaps titanium or certain of the precious metals. Operation is possible at 100°C, using a wide variety of materials of construction, including stainless steel, if sufficient excess acid is incorporated in the solution to prevent precipitation. Physics. Aside from minor dimensional corrections to conform to mechanical design values, the calculations of critical mass are complete and indicate a favorable assembly. The question of shimming and of safety and regulating rods is still incomplete. The transient operation of the reactor was such as to sustain instantaneous changes of reactivity amounting to 2% effective. There was evidence that the dampening due to delayed neutrons and cooling is of such magnitude that oscillations about equilibrium power will be very small. Preliminary investigation of the origin of reactivity changes showed that all such changes took place over a reasonable time interval and that estimates made on the basis of instantaneous changes were very conservative. The interpretation of the over-all physical picture was that the homogeneous reactor is self-controlling for a reactivity change far in excess of that which would completely destroy most of the other types of reactors so far proposed. Engineering and Design. Preliminary designs are given for the reactor and auxiliaries. A program is reported to design and construct a non-nuclear model to demonstrate the feasibility of operating at 1000 psi and 250°C. (auth)

**5406** ORNL-824
Oak Ridge National Lab., Tenn.
THE CORROSION OF MINIATURE FUEL PLATES IN SIMULATED REACTOR COOLING WATER. James L. English. Dec. 18, 1950. Decl. Jan. 6, 1956. 27p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The corrosion resistance of miniature fuel plates was evaluated in 0.005M $H_2O_2$ at 85°C. The individual plates consisted of an U—Al core clad with a layer of 2S Al and 72S Al. The fuel plate samples were in four groups, each of which represented a different processing practice in the fabrication of fuel plate assemblies. The corrosion test was conducted for 3 months with monthly sample inspections. All four groups of samples exhibited good corrosion resistance during the first month of exposure, but localized corrosion attack became prominent on several groups during the last two months of the test. Corrosion rates, calculated on the assumption that corrosion was of a uniform nature, were 0.18 mil/year and less on all groups at the end of 3 months. Of major significance, however, was the formation and development of pitting attack. Test results and data indicate that penetration of the protective Al cladding to the U—Al core occurred in one instance. Specimens prepared by hot rolling followed by cold rolling exhibited the best resistance to localized corrosion attack of the four groups. These samples were designated as Group 1. The maximum pit depth observed on the samples after 3 months was 8.4 mils. Samples in Group 4 showed the next best corrosion resistance; maximum pit penetration on these specimens was 10.0 mils after 3 months. The most severe penetration, 17.6 mils, was observed on specimens in Groups 2 and 3 after 3 months of exposure. (auth)

**5407** ORNL-826
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1950. Oct. 24, 1950. Decl. Jan. 13, 1956. 158p. Contract W-7405-eng-26. $24.30(ph OTS); $7.50(mf OTS).

Progress is reported on engineering design, engineering development, control and simulator, reactor physics, recombination of H and O, chemical studies, and corrosion. (B.J.H.)

**5408** ORNL-1205
Oak Ridge National Lab., Tenn.
KINETIC CALCULATIONS FOR HOMOGENEOUS REAC-

TORS. W. C. Sangren. Apr. 15, 1952. Decl. Dec. 29, 1955. 93p. Contract W-7405-eng-26. $0.50(OTS).

A large portion of the kinetic calculations for homogeneous reactors is surveyed. Particular thermal, nuclear, and pressurizer systems containing only bulk or average quantities are considered. Most of the investigations dealt with the results of step increases in reactivity. Several non-analytical methods of calculation were used. (B.J.H.)

**5409** TID-5029
North American Aviation, Inc., Downey, Calif.
TEMPERATURE EFFECT IN $D_2O$ URANIUM LATTICES. A. T. Biehl and E. R. Cohen. [1951]. Decl. Jan. 13, 1956. 3p. (NAA-SR-Misc-4). $1.80(ph OTS); $1.80(mf OTS).

By comparing the flux distribution in similar multiplying and nonmultiplying lattices, the relative mean neutron velocities in these lattices and the effective temperature have been determined. The multiplying lattice consisted of U rods clad in Al tubes while the nonmultiplying lattice was achieved by replacing the U with a Pb–Cd alloy. These measurements were checked through the use of Eu foils which had been calibrated against Au foils in a thermal flux. (B.J.H.)

**5410** TID-5072
[Battelle Memorial Inst., Columbus, Ohio.]
HIGH-SPEED PHOTOGRAPHY IN REACTOR MECHANISM DEVELOPMENT. P. F. Forgrave, G. A. Waldie, and R. M. Conklin. [1952]. Decl. Jan. 13, 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

A high-speed motion-picture camera was used to aid in the development of a scram-latch mechanism for the Mark I submarine reactor. Although the mechanism developed in this way was not used, it appeared that the high-speed photography method should be of use in reactor mechanism development. (B.J.H.)

Refer also to abstracts 5134, 5214, 5215, and 5306.

## PARTICLE ACCELERATORS

**5411** NAA-SR-21
North American Aviation, Inc., Los Angeles.
CYCLOTRON TECHNIQUES IN STUDIES OF RADIATION EFFECTS. H. P. Yockey. Dec. 22, 1948. Decl. Jan. 10, 1956. 18p. Contract AT-11-1-Gen-8. $3.30(ph OTS); $2.40(mf OTS).

Techniques are outlined for utilizing the 60-in. cyclotron at Berkeley for studying the effects of radiation on materials. Measurements of beam intensity distribution for protons, deuterons and alpha particles are described. Range straggling curves are presented for aluminum and carbon (graphite). (auth)

**5412** UCRL-2203
California. Univ., Berkeley. Radiation Lab.
LIMITATIONS ON BORE, ENTERING BEAM, AND VOLTAGE GRADIENTS IN THE STRONG FOCUSING LINEAR ACCELERATOR. Myron Good and Lloyd Smith. May 1, 1943. Decl. Jan. 16, 1956. 2p. Contract [W-7405-Eng-48]. $1.80(ph OTS); $1.80(mf OTS).

**5413** UCRL-2246
California. Univ., Berkeley. Radiation Lab.
LIMITATIONS ON BORE, ENTERING BEAM, AND VOLTAGE GRADIENTS IN THE STRONG FOCUSING LINEAR ACCELERATOR. [PART] II. Myron Good and Lloyd Smith. June 12, 1953. Decl. Jan. 12, 1956. 5p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

## RADIATION ABSORPTION AND SCATTERING

**5414** UCRL-1715
California. Univ., Berkeley. Radiation Lab.
ANALYSIS OF THE ENERGY OF NEUTRONS EMERGING FROM THE TARGET BY MEANS OF THEIR SPATIAL DISTRIBUTION. H. Brown. Mar. 5, 1952. Decl. Jan. 16, 1956. 4p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

Attempt is made to use results obtained from neutron slowing down in $H_2O$ to extrapolate the energy distribution of neutrons emerging from large U blocks. It was found that simple age theory must be incorrect for the case of water, since Ra–Be sources have ages not much greater than fission sources, though the average neutron energy is much higher (5 Mev compared with 2 Mev.) (L.M.T.)

## RADIATION EFFECTS

**5415** AECD-3940
Argonne National Lab., Lemont, Ill.
OAK RIDGE STATIC AUTOCLAVE WATER DECOMPOSITION TEST. J. R. Humphreys, Jr., A. L. Abers, and P. E. Brown. May 1, 1951. Decl. with deletions Jan. 5, 1956. 36p. Contract W-31-109-eng-38. $6.30(ph OTS); $3.00(mf OTS).

A Type 347 stainless steel autoclave was surrounded with a flux converter containing natural U to increase the epithermal neutron flux and was installed in a reactor hole. Steady-state concentrations of gaseous decomposition products of pure $H_2O$ under irradiation at temperatures varying from 200 to 500°F were made. Extrapolation of the steady-state values obtained indicates the upper limit of the partial pressure of the decomposition products of pure water in Mark I, without degasifying and without catalytic recombination. Recombination studies were made by adding $H_2$ and $O_2$ gases to water under irradiation at different temperature and flux levels. The data show a significant effect of temperature on the rate of pressure drop of the added H and O. (G.Y.)

**5416** AECD-4045
Clinton Labs., Oak Ridge, Tenn.
EFFECTS OF PILE RADIATION ON BE METAL. Sidney Siegel. June 10, 1947. Decl. with deletions Jan. 10, 1956. 6p. Contract W-35-058-eng-71. $1.80(ph OTS); $1.80(mf OTS).

A set of Be metal rods was prepared by casting, extrusion, and machining to a final size $\frac{3}{16}$-in. diam. and about $2\frac{1}{2}$ in. long. The effects of reactor radiation on the length, density, electrical resistivity, frequency of longitudinal vibration, and damping of mechanical vibrations of the samples were measured. (B.J.H.)

**5417** M-3300
Clinton Labs., Oak Ridge, Tenn.
EFFECTS OF PILE RADIATION ON Be METAL. Sidney Siegel. Nov. 27, 1946. Decl. Jan. 13, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

Values of resonant frequency, equivalent resistance, and length of Be metal before and after reactor irradiation are tabulated. The radioactivity of the Be sample after irradiation is also discussed. (B.J.H.)

**5418** NAA-SR-37
North American Aviation, Inc., Los Angeles.
PRELIMINARY EXPERIMENTS ON RADIATION DAMAGE DUE TO ELECTRON BOMBARDMENT. D. T. Eggen and W. E. Parkins. Sept. 12, 1949. Decl. Jan. 11, 1956. 12p. Charge $3.30(ph OTS); $2.40 (mf OTS).

Preliminary experiments show atomic displacements

can be produced in solids by energetic electrons. Specimens of graphite and $Cu_3Au$ alloy were exposed to a 1-Mev Van de Graaff electron beam. Changes were measured in the electric resistivity and temperature coefficient of electric resistivity of the graphite. These changes were approximately one-fifth as large as those observed in deuteron irradiated graphite for the same total energy density dissipation within the specimen. (auth)

**5419** NAA-SR-38
North American Aviation, Inc., Los Angeles.
THEORY OF ATOMIC DISPLACEMENTS PRODUCED BY FAST ELECTRONS. M. M. Mills. Jan. 20, 1950. Decl. Dec. 6, 1955. 46p. Contract AT-11-1-GEN-8. $0.30 (OTS).

Theoretical computations are given describing the production of atomic displacements in graphite by fast electrons. The underlying mechanism is assumed to be the elastic transfer of energy from the electron to a struck carbon atom as a whole when the electron encounters the Coulomb field of the carbon nucleus. The agreement between recent experimental electron bombardment data and the theory proposed here is good enough to indicate that the proposed mechanism is probably correct, and that intense ionization does not lead to atomic displacement effects in graphite. The low mass of the electron makes electron bombardment a sensitive technique to supplement irradiation studies of materials carried out by other methods; for example, electron bombardment offers a suitable method to determine the energy necessary to displace an atom from its normal lattice site. Radiation damage in reactors, produced by electrons, is negligible in comparison to damage produced by fast neutrons; however, it is possible for fast electrons to produce radiation damage. (auth)

**5420** ORNL-129
Oak Ridge National Lab., Tenn.
CALORIMETRIC MEASUREMENT OF RADIATION ENERGY DISSIPATED BY VARIOUS MATERIALS PLACED IN THE OAK RIDGE PILE. D. M. Richardson. Dec. 23, 1948. Decl. Dec. 7, 1955. 30p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

The total amount of energy absorbed by carbon, water, heavy water, aluminum and bismuth in the Oak Ridge pile was determined calorimetrically. The calorimeter consisted essentially of two concentric aluminum cylinders with an air gap between, good thermal insulation being provided at each end; the steady-state temperature difference across the gap provided a measure of the rate of heat production of the material inside. Calibration was obtained by electrical heating of the inner cylinder. By use of an assumed fast neutron spectrum, the observed heats were broken down into the parts arising from neutron scattering and gamma-ray absorption. The results are probably accurate to about 3%, and energy absorbed by practically any material from pile radiation at the point of measurement can be estimated from the results. The fast neutron flux obtained from the calorimetric results checked well with a determination of the amount of n,p reaction on sulfur. Use of the present results for obtaining energy absorbed at any other point in the pile graphite is discussed. (auth)

**5421** ORNL-277
Oak Ridge National Lab., Tenn.
THE EFFECT OF RADIATION ON A DIFFERENTIAL TRANSFORMER. C. E. Stilson. Aug. 16, 1948. Decl. Jan. 13, 1956. 10p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

A differential transformer was tested in an operating reactor to determine its suitability as a position-sensory instrument in the reactor. Output voltages are given as a function of time in the ORNL Graphite Reactor. (B.J.H.)

**5422** WAPD-31
Westinghouse Electric Corp., Pittsburgh.
IN-PILE TEST OF MICROFORMER. L. A. Cook and W. E. Johnson. May 14, 1951. Decl. Jan. 16, 1956. 7p. $1.80 (ph OTS); $1.80(mf OTS).

Two types of microformers (linear differential transformers used as strain-indicating devices) were subjected to irradiation stability tests in Hanford process tubes. The first test consisted in measuring the electrical output as a function of core position before and after a 6-weeks irradiation. No change was noted. Resistance measurements of the individual coils and insulation indicated no measurable breakdown in insulation. The second test was 3-month in-pile irradiation during which data on electrical resistivity of the Zr sample, the temperature of which could be cycled, and microformer output was recorded. After 1200 hr, breakdown of undetermined origin occurred, as shown by a sharp drop in the resistance to ground of the output circuit. It is concluded that a microformer can probably be relied on for a 1000-hr period in a Hanford reactor and the resistance-to-ground measurements can be relied on to indicate breakdown. (L.M.T.)

## RADIOACTIVITY

**5423** CF-55-6-43
Oak Ridge National Lab., Tenn.
CALCULATIONS OF GAMMA COUNTING RATE OF THORIUM. S. A. Reynolds. June 8, 1955. Decl. Dec. 20, 1955. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS) $2.40(mf OTS).

The natural gamma activity associated with thorium in the Thorex Process has been estimated on the basis of several calculations and scintillation counter measurements. The relative activity of Th as a function of time after purification is tabulated. (C.W.H.)

## SHIELDING

**5424** CF-50-8-17
[Oak Ridge National Lab., Tenn.]
SHIELDING OF NUCLEAR REACTORS; LECTURE II. NEUTRON AND GAMMA CROSS SECTIONS. E. P. Blizard. Aug. 8, 1950. Decl. Jan. 6, 1956. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The interactions of $\gamma$ radiation and neutrons with matter are briefly discussed. (B.J.H.)

**5425** CF-52-12-34
Oak Ridge National Lab., Tenn.
CP-6 THERMAL SHIELD EXPERIMENTS. E. P. Blizard. Dec. 6, 1952. Decl. Dec. 16, 1955. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $3.00(mf OTS).

A mockup of the Argonne Neutron Production Reactor iron-water shield was tested in the Lid Tank Facility. Data are presented from measurements of thermal neutron flux and $\gamma$ doses at various distances from the source and with various shield configurations. (M.P.G.)

**5426** IDO-16011
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
SHIELDING REQUIREMENTS FOR EXPERIMENTS ANL 2 AND KAPL 2. H. L. McMurry. Apr. 1, 1952. Decl. Jan. 7, 1956. 10p. $0.15(OTS).

In order to determine whether certain experiments containing $U^{235}$ can be handled safely in the lead coffin or proposed hot cave, calculations were made of the $\gamma$ activities and dose rates behind various shields for experiments ANL 2 and KAPL 2. (auth)

**5427** ORNL-636
Oak Ridge National Lab., Tenn.
THE ATTENUATION OF PILE GAMMAS THROUGH WATER, LEAD AND IRON. C. E. Clifford. Dec. 13, 1949. 11p. Contract [W-7405-eng-26]. (CF-49-12-44). $3.30 (ph OTS); $2.40(mf OTS).

Measurements were made in the shield testing facility of the attenuation of the pile gammas through water, and water plus lead and iron. A measurement was made along the center line of the small tank within the shield filled with water. This tank has an incident thermal neutron flux of $10^{10}$ n/cm$^2$/sec and an incident gamma flux of $10^4$ r/hr. The measurements in the internal tank extended through 240 cm of water. After installation of the external tank, measurements were extended in it to a total of 420 cm of water along the axis of the hole. Integral measurements were also made in the external tank of all the radiation passing z planes (perpendicular to the source) at 25 cm intervals. The total attenuation measured was $10^7$ for 410 g/cm$^2$ not corrected for geometry. The last 150 cm appeared to be exponential with a relaxation length of 31.5 cm. The integral curve also appeared to be exponential with a 36.3 cm relaxation length. Measurements through iron and lead in the outer tank gave relaxation lengths 4.45 cm and 2.30 cm, respectively. (auth)

**5428** ORNL-748(Suppl.)
Oak Ridge National Lab., Tenn.
SHIELD CALCULATIONS FOR LEAD AND WATER MIXTURES. F. H. Murray. Dec. 11, 1950. Decl. Jan. 6, 1956. 7p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

The penetration of neutrons through mixtures of Pb and $H_2O$ is calculated. The general formulas given for 20% Pb, 30% Pb, 40% Pb include the contribution of the continuous spectrum; the calculations show the necessity of using this contribution for distances up to about half a meter from the source plane, so that a better fit with empirical data can be expected at small distances. When certain corrections for the high-energy theoretical curves, and other corrections to empirical curves are estimated, a fair agreement with the experimental results for 33% Pb is indicated. (auth)

**5429** TID-270
Technical Information Service, AEC.
SHIELDING. Reports from Session IV, General Information Meeting October 24, 25, 26, 1949, Oak Ridge, Tennessee. Decl. Jan. 12, 1956. 57p. $9.30(ph OTS); $3.60(mf OTS).

Included are papers on approaches to the design of a minimum weight shield, the theory of $\gamma$ and neutron attenuation in shields, fundamental shielding information, bulk shielding tests, and the properties of shielding materials. (B.J.H.)

## SPECTROSCOPY

**5430** M-3095
[Iowa State Coll., Ames.]
THE SPECTROGRAPHIC ANALYSIS OF HIGH PURITY MAGNESIUM METAL. V. A. Fassel. [1944?]. Decl. Jan. 10, 1956. 10p. Contract [W-7405-eng-82].

This report is based on CC-1061 and CC-1517 (Mar. 10, 1943). $1.80(ph OTS); $1.80(mf OTS).

A spectrographic method for the simultaneous determination of B, Cd, and Mn in high-purity Mg metal was developed. This method is based on the d-c arc excitation of MgO charges weighed into graphite electrode cavities. It is capable of an accuracy of ±5 to 10%. (auth)

## URANIUM AND URANIUM COMPOUNDS

**5431** CP-3580
Argonne National Lab., Lemont, Ill.
RESONANCE ABSORPTION OF URANIUM. N. Goldstein and D. J. Hughes. Aug. 10, 1946. Decl. Jan. 4, 1956. 13p. Contract W-31-109-eng-38. $3.30(ph OTS); $2.40(mf OTS).

Using pile neutrons and depleted uranium oxide foils, the effective resonance integral ($\sigma$ dE/E) was measured for uranium metal, various mixtures of graphite and uranium oxide, and graphite using the $\int\sigma$ dE/E for indium as a comparison. Scattering effects of foil materials and adequate thinness of foils were carefully checked. The results were plotted as a function of scattering cross section per uranium atom. For metal 8.2 b/$U_{atom}$ scattering cross-section, the integral is 9.0 ± 0.16 b and for graphite the value is 221 ± 1.6 b. These values do not include the errors involved in the constants, which were about 10% and would raise or lower all the results proportionately. (auth)

**5432** CUD-55
Columbia Univ., New York.
HIGHER RESOLUTION NEUTRON VELOCITY SPECTROMETER MEASUREMENTS OF ENRICHED URANIUM. W. W. Havens, Jr. and L. J. Rainwater. Aug. 8, 1950. Decl. Dec. 21, 1955. 6p. Contract AT-30-1-gen-72. (DR-1426). $1.80(ph OTS); $1.80(mf OTS).

The slow neutron transmission of a sample of enriched U containing 3.193 gm/cm$^2$ was investigated with a resolution width of 1 $\mu$sec/m. Results of transmission measurements are shown graphically. (B.J.H.)

**5433** KAPL-793
Knolls Atomic Power Lab., Schenectady, N. Y.
AVERAGE NEUTRON WIDTH, RADIATIVE WIDTH, AND LEVEL SPACING FOR U-238 IN THE REGION 1 KV TO 400 KV. J. A. Rich. Aug. 15, 1952. Decl. Dec. 6, 1955. 19p. Contract W-31-109-Eng-52. $0.20 (OTS).

The theory of nuclear reactions has been applied to $U^{238}$ and the nuclear parameters relevant to the proposed PPR (plutonium power reactor) have been deduced from the available experimental data. These nuclear parameters include the average neutron width, radiative width, and level spacing for $U^{238}$ in the range 1 kv to 400 kv, the approximate resonance parameters $\sigma_0$, $\Gamma$, and $\Gamma_n$ for the 6.6 ev resonance of $U^{238}$, and the incident neutron energy for which the neutron width equals the radiative width. (auth)

**5434** KAPL-1109
Knolls Atomic Power Lab., Schenectady, N. Y.
A HIGH-RESOLUTION MEASUREMENT OF THE FISSION CROSS SECTION OF U-235 IN THE ENERGY RANGE 1 TO 40 KEV USING THE GE BETATRON VELOCITY SELECTOR. M. L. Yeater, P. L. Kelley, and E. R. Gaerttner. June 4, 1954. Decl. Dec. 5, 1955. 21p. Contract W-31-109-Eng-52. $0.15(OTS).

The relative fission cross section of $U^{235}$ was measured in the range from about 1 to 40 kev and normalized to earlier Columbia measurements. The detector was the Columbia fission chamber; a $BF_3$ counter was used to obtain the neutron spectrum from the betatron, on the assumption of a 1/v dependence for the boron cross section. Resolution of the velocity selector was about 0.12 $\mu$sec/m. Normalization was effected by curve matching to the latest Columbia data in the energy range 0.3 to 0.7 ev. Agreement is good, for points suitably averaged, between the upper energy end of the Columbia curve and the average of the points on the lower energy end of the present curve, in the energy range 700 to 4000 ev. (auth)

**5435** LA-485
[Los Alamos Scientific Lab., N. Mex.]
RATIO OF THE THERMAL FISSION CROSS SECTIONS OF 23 AND 25. J. W. DeWire. Jan. 2, 1946. Decl. Dec. 13, 1955. 6p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

The ratio of the fission cross sections of $U^{233}$ and $U^{235}$ for thermal neutrons was found to be 0.90 ± 0.015. From the reported value $\sigma_f(U^{235})$ = 542 barns, the resultant $U^{233}$ is 488 barns. This quantity together with $\sigma_a(U^{233})$ = 566 barns, gives a $(U^{233})$ = 0.16. (auth).

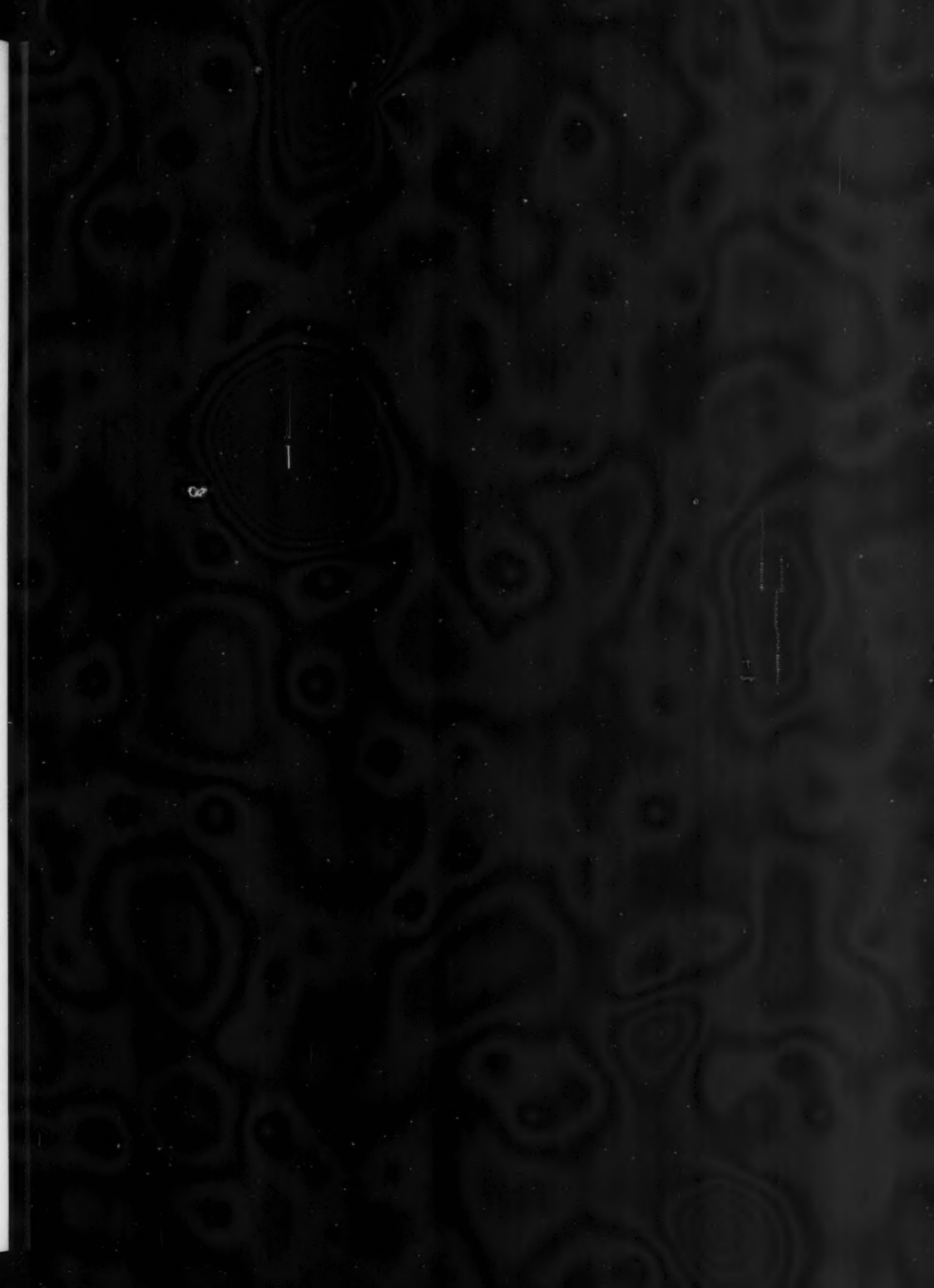
**5436** M-4528
[Electro Metallurgical Co., Niagara Falls, N. Y.]
PRODUCTION REPORT ON TUBEALLOY [Uranium] METAL BY ELECTRO METALLURGICAL COMPANY. Glen D. Bagley. May 14, 1943. Decl. Jan. 11, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

The production of uranium by the reduction of $UF_4$ by Mg in bombs of various sizes was demonstrated on a laboratory scale. The effect of $UF_4$ particle size on the U yield was investigated. The remelting and cutting of U ingots was described. (C.W.H.)

**5437** MonP-47
[Clinton Labs., Oak Ridge, Tenn.]
THE MULTIPLICATION FACTOR FOR PRODUCT DRUMS CONTAINING URANIUM HEXAFLUORIDE. Problem Assignment No. PX14-1. A. H. Snell and J. H. Rush. Nov. 30, 1945. Decl. Jan. 11, 1956. 39p. Contract W-85-058-eng-71. $7.80(ph OTS); $3.30(mf OTS).

The multiplication factors for 300-lb product drums containing $UF_6$ were measured by placing a fission source in the center of the drum and deriving the total number of secondary fissions produced in the $UF_6$ per primary fission in the source. The measurements were made using material having isotopic concentrations of $U^{235}$ of 1.1% and 0.536%. The effect of a hydrogeneous reflector around the drum was studied as was the degree of protection to be gained by Cd and B jackets. An extrapolation of the results indicates that a drum would become critical if it contained $UF_6$ with about 10% isotopic concentration of $U^{235}$, if it were surrounded with $H_2O$ and had no Cd cover. If dry or Cd-covered, the concentration would have to be several times greater for criticality. (auth)

**5438** TID-355
Technical Information Service, AEC.
ENRICHMENT OF GRAM QUANTITIES OF U 234. Paper 14 of Session V, General Information Meeting, October 24, 25, 26, 1949, Oak Ridge, Tennessee. Benjamin Harmatz. Decl. Jan. 12, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

The production of enriched $U^{234}$ using a two-stage beta calutron process is briefly discussed. (B.J.H.)

Refer also to abstract 5289.